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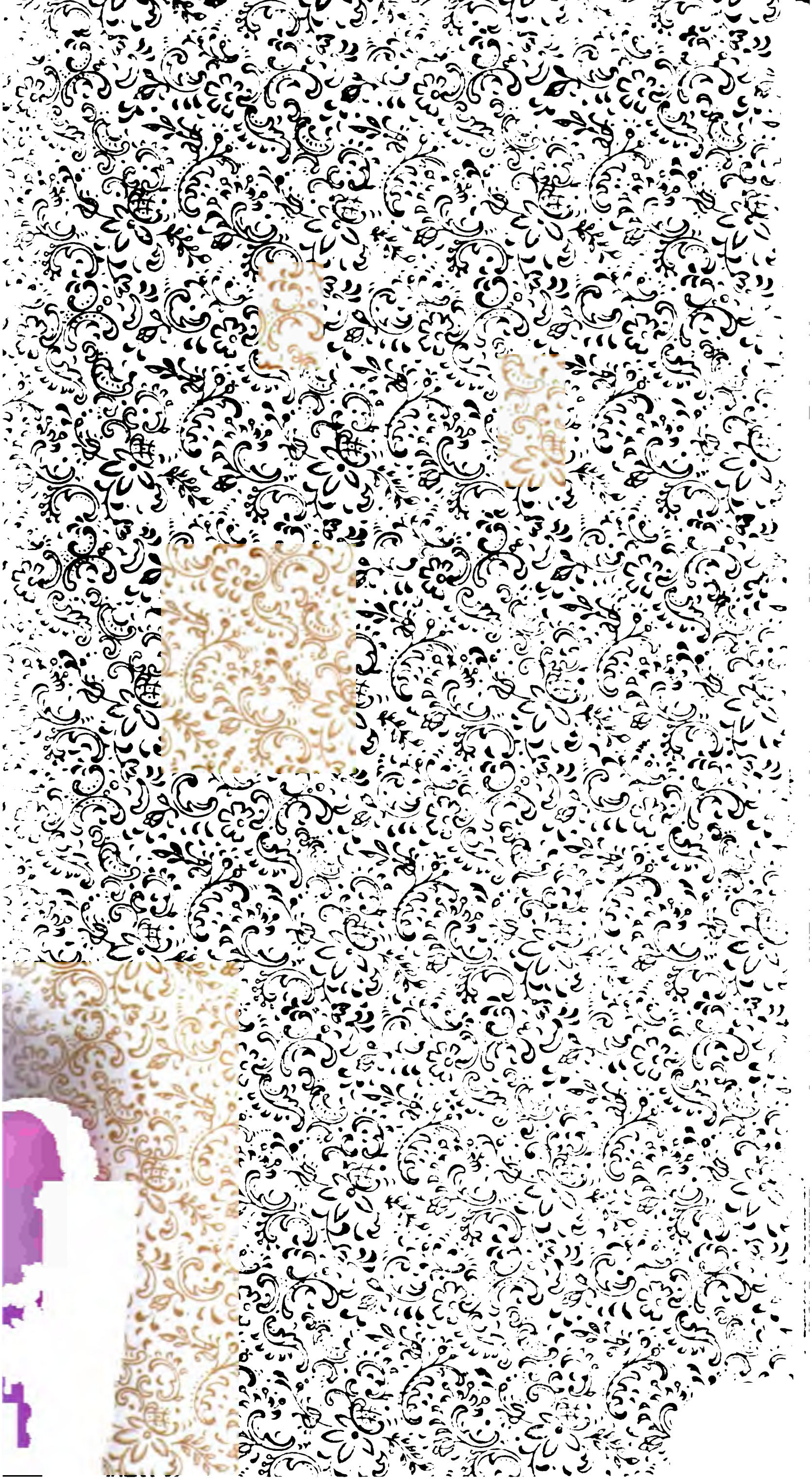

PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR

1889.

TASMANIA:
PRINTED AT "THE MERCURY" OFFICE, MACQUARIE ST., HOBART.

1890.

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1891

The Responsibility of the Statements and Opinions given in the following Papers and Discussions rests with the individual Authors; the Society as a body merely places them on record.

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ROOT MATTERS IN SOCIAL AND ECONOMIC PROBLEMS.

ADDENDA ET CORRIGENDA.

Average Rate of Wages. At page 25 the average rate is based upon all kinds of breadwinners'; at page 48 the average rate is based upon the wages of *male adults* of about 12 selected occupations.

Definition of Certain Terms Employed.

Wants. This term is used in a double sense throughout the various chapters : (1) the term is often used in its more legitimate sense, viz., *appetites*, *cravings*, or *desires* ; (2) the term, however, is also employed less correctly in the sense of the *things*, *objects*, or *desiderata* which satisfy cravings. It is used in the latter sense when such terms as the following are used :—"creation of wants," "wants in exchange," "aggregate of primary wants," "wants essential to life," "wants essential to comfort," "production of wants," "struggle for wants," "supply of wants," etc. It is used in the former sense in the following phrases :—"wants are interminable," "satisfaction of wants," "sufficiency for the wants of all," etc. On reconsideration it would, perhaps, have been an improvement if the term *wants* had been restricted to its more legitimate use, as indicating cravings and desires, or lacks ; and that the term *satisfactions* should have been substituted where the things *wanted* are concerned.

ERRATA.

Page 6, line 8, *For* are greatly . . . are enjoyed *read* is greatly . . . is enjoyed.
Page 6, line 16, *For* satisfaction *read* satisfactions.
Page 10, line 28, *For* very *read* fairly.
Page 15, line 5 from bottom, *For* satisfaction *read* satisfactions.
Page 17, line 9, *For* increase *read* decrease.
Page 19, line 8, *For* polemist *read* athlete.
Page 20, line 28, *For* the ideal state *read* the people of the ideal state.
Page 22, after line 31, *For* figures given *substitute* $\frac{200\times8}{150} = 10{\cdot}66$ hours.
Page 22, line 37, *For* per day *read* per day fully.
Page 23, line 5 from bottom, *For* £130,000,000 *read* £1,300,000,000.
Page 25, line 10 from bottom, *For* ditto *read* earnings of ditto.
Page 25, line 7 from bottom, *For* ditto *read* average wages per head.
Page 26, line 19, *For* her purchasing *read* England's purchasing.
Page 29, line 1, *For* casual *read* causal.
Page 31, line 4, *For* them *read* proprietors of land.
Page 31, line 6, *For* thus *read* this.
Page 31, line 23, *For* it as a possible ingredient *read* them as possible ingredients.
Page 31, line 24, *For* it no more *read* they no more.
Page 36, line 32, *For* variety *read* rarity.
Page 64, line 31, *For* unsoluble *read* insoluble.

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ROYAL SOCIETY.

APRIL, 1889.

A meeting of the Royal Society of Tasmania was held at the Tasmanian Museum on April 16th. The President, His Excellency Sir Robt. G. C. Hamilton, K.C.B., presided, and there was a large attendance of Fellows and ladies, including Lady Hamilton.

The secretary laid on the table the following additions to the library:—

Annual Report of the Curator of the Museum of Comparative Zoology at Howard College for 1887-8.—From the Department.

Boletem da Sociedade de Geographia de Lisboa, 7A serie. No. 9, 10.—From the Society.

Bolelin Mensual, Mexico. Tomo 1. Nos. 8 to 10.—From the Department.

Bollettino della Societa Geographica Italiana, Serie III., Vol. 1, Fase IX. XII.—From the Society.

Bulletin de la Société Impériale des Naturalistes de Moscow, No. 3, Moscow.—From the Department.

Bulletin de la Société D'Ethnographie, Paris.—From the Society.

Bulletin of the Museum of Comparative Zoology at Howard College, whole series vol. XVI, Nos. 2 and 3, "On the geology of the Cambrian, District of Bristol, County Mass. By N. S. Shaler.

"Fossil Plants collected at Golden, Colorado." By Leo Lesquerliex.

Bulletin de la Société Académique Indo-Chinoise de France. Deuxiéme Série—Tome Deuxieme.—From the Society.

Descriptive Catalogue of the Sponges in the Australian Museum, Sydney. By K. Von Lendenfeld, P L. D.—From the Trustees.

Flora of British India, The. By Sir J. D. Hooker, C.B. Part XV.—From the Department.

Indian Meteorological Memoirs. Vol. III., parts III., IV.; Vol. IV., part 5.—From the Department.

Journal of the Royal Microscopical Society. Current numbers.—From the Society.

Key to the system of Victorian Plants, Dichotomous arrangements of the orders, genera and species of the native plants, with annotations of primary distinctions and supporting characteristics. Parts 1 and 2, 1887-8. By Baron Müeller.—From the Author.

Meteorologische Bebbachtunjen, Moscow.—From the Department.

Meteorological Report of New Zealand for 1885.—From the Department.

The Mineral Wealth of Queensland. By R. L. Jack, F.G.S.—From the author.

Monthly Notices of the Royal Astronomical Society. Current Numbers.—From the Society.

Monthly Weather Report, Canada.—From the Department.

Vol. XVII., No. 2, on the lateral canal system of the Selachia and Holœphold. By Samuel Green.—From the Department.

Proceedings of the Canadian Institute, Toronto, October 1888.—From the Society.

Proceedings of the Linnean Society of New South Wales, vol. III., part 3rd.—From the Society.

Prodromus of the Zoology of Victoria, Decade XVII. By Prof. F. McCoy, C.M.G.—From the Department.

Proceedings of the Royal Society of Queensland, 1887, vol. IV.; 1888, vols. III. IV. V.—From the Society.

Psyche, a journal of Entomology, vol. 5, Nos. 149 to 153.—From the Society.

Report of the Mount Morgan gold deposits, Queensland, 1889. By R. L. Jack, Government Geologist.—From the Author.

Scottish Geographical Magazine. Current Numbers.—From the Department.

Select Extra-Tropical Plants, readily eligible for Industrial Culture or Naturalisation, with indications of their native countries, and some of their uses. By Baron F. Von Müeller. From the Author.

Systematic Account of the Geology of Tasmania. By R. M. Johnston, F.L.S.—From the Government.

Tabular list of all the Australian birds at present known to the author, showing the distribution of the species over the continent of Australia and adjacent islands. By E. P. Ramsay, LL.D., etc.—From the Trustees Australian Museum.

Transactions of the Asiatic Society of Japan. Vol. X.V.I., Part II.—From the Society.

Transactions and Proceedings of the Royal Geographical Society of Australasia (Victorian Branch). Part II., Vol. VI.—From the Society.

Verhandlungen des naturhistorischen, Vereines des preussischen Rheinlande, Westfalens und des Reg. Bezirks Osnabrück.—From the Society.

Verhanalungen der Gesellschaft Für, Erdkunde Band, XV., Nos. 7, 8, 10. From the Society, Berlin.

Victorian Year Book for 1887-8.—From the Government Statist.

HIS EXCELLENCY stated that there were two interesting papers to be read, and a number of equally interesting ones were promised during the session. Many of the subjects brought forward did not lend themselves readily to discussion, but he would like to see the Fellows of the Society intimate with any subject laid before them to give them the benefit of their opinions. This would make their meetings more lively and interesting, and also gave an opportunity to those who had read papers to correct any misunderstandings or wrong impressions that may have arisen from the reading of those papers. He trusted, therefore, that they would have freer and fuller discussions than they had had during previous sessions.

PAPERS.

THE "IRON BLOW" AT THE LINDA GOLDFIELD.

Mr. ALEX. MORTON, F.L.S., read a paper by Mr. Gustav Thureau, F.G.S., on "The 'Iron Blow' at the Linda Goldfield." In it the writer gave his opinion that this unique gold formation was due to volcanic agency, and not as Mr. R. M. Johnston contended, to local decomposition, especially as far as the dark-coloured and pulverulent masses are concerned. Decomposition, he believed, was a chemical process by which the destruction of one or more substances leads to the substitution and depositing of quite different matters, thereby bringing about the re-arrangement of the former original substances in quite different forms. The analyses of Mr. Ward conclusively proved the almost total absence of gold in the pyrites veins or beds, which are very dense and excessively solid, and which have undoubtedly resisted both decomposition and dissolution for ages, therefore he asked how it was possible that these almost non-auriferous vein bi-sulphides produced on their supposed (inert) decomposition that peculiar purple mineral, assaying, as reported, considerably above 170oz. of gold to the ton. Again, those very solid pyrites contain no barytes, which latter minerals he first discovered as the necessary adjunct to the gold. Supposing, however, as Mr. Johnston had stated, that the "Iron Blow is the result of oxidation of pyrites similar to that now so largely associated with it," it would be necessary to bear in mind that as proved from analysis they had first to deal with a nearly non-auriferous bi sulphide of iron, containing no baryta to speak of, and, secondly, that water is assumed to have produced the rich pulverulent gold rock by means of the decomposition of the former, and contemporaneously or subsequently by means of infiltration filled the fissure, and that small disseminated particles of baryta appeared either before or during the process of oxidation. In his (Mr. Thureau's) opinion everything points to a more drastic process of origination than simple and quiescent decomposition, and to him it becomes clear to the close and careful observer of these unique gold deposits *in situ* that dynamical geology can alone account for these strictly speaking volcanic products. Having had opportunities for examining active "mud volcanoes" in the United States, and as the process observable there in active progress assimilates a great deal to what can be seen in its "dead state" at the "Iron Blow" of baryta is substituted for silica, as matrix in the latter case, the question of origin as to both metalliferous deposits is not only in his opinion, very suggestive, but forms the only possible true solution of the case.

In consequence of the absence of Messrs. Johnston and Ward it was decided to postpone discussion until next meeting.

TIDE OBSERVATIONS AT HOBART.

Mr. A. **MAULT** read a paper on "Some tide observations taken at Hobart during February and March, 1889," in which he stated that with a wish, firstly, to obtain information connected with the drainage of Hobart, and, secondly, to fix the mean sea level for geodetic and engineering matters to get a series of tidal observations, he had arranged with Captain Oldham, of H.M.S. Egeria, that observations be taken at the New Wharf by the automatic tide gauge belonging to that boat, and the result briefly was as follows:—1. The tides are subject to a large diurnal inequality, the highest high water being followed by the lowest low water. The tide then rises to a lesser high water and falls to a lesser low water. 2. With the moon's declination north the higher high water follows the superior transit of the moon; with the moon's declination south the higher high water succeeds the inferior transit. 3. The greatest range of tide appears to occur about two days after the moon has reached its greatest north or south declination: the least range when the declination is zero. 4. H.W.F. and C. occurs at Hobart at 8h. 15m. Springs rise 3¾ft. to 4½ft. and 2ft., neaps 2½ft. In the letter to him from Captain Oldham the following words occur:—"From these observations the mean tide level is 8ft. 2·7in. on the gauge or 35·255ft. below the datum mark on the Town Hall." In the letter it was also stated that, as these observations were only for one month and as probably the mean tide level varies at different seasons, to get a satisfactory result a year's observation should be obtained." He (Mr. Mault) was glad to say that the Hobart Marine Board were obtaining an automatic gauge, so that the observation could be continued. For the purpose of more readily comprehending the information contained in those observations, he had prepared diagrams showing the occurrence of springs at greatest declination, and not at new and full moon, and that there is no "age of the tide" at Hobart. Diagrams were also appended, showing, for comparison, a fortnight's tide curves at Hobart, and a fortnight's at Bombay, and another representing a normal curve of lunitidal intervals. The irregularities which appeared by these diagrams showed that no time of high water on the day of new or full moon could be fixed, although Captain Oldham mentions 8h. 15min. He pressed on the Society the need of co-operating with the Marine Board in the taking of observations. The force and direction of the wind also had an influence that must be noted. The highest tides occurred with the wind blowing from north and north-easterly points. The barometer also should be noted, as a fall of 1in. in the barometer meant a rise of 20in. in the sea level. He also suggested that the Marine Board be asked to get their lighthousekeepers to keep a register of the high and low water times.

A DESIRABLE CHANGE.

Mr. W. **BENSON** read a paper in which he pointed out that the work of the Society had and was rendering practical and substantial benefits to the colony at large, but was of opinion that it might be made of still greater interest and value. There were two classes amongst the members, first savants or specialists, and secondly those who had not thoroughly studied any special subject. So far as the meetings of the Society were intended for the interchange of notes upon new discoveries, the reading of papers prepared by savants and specialists was natural and proper, though he doubted whether those who merely heard them read could gain as full a knowledge of their contents as they could by studying them in the Society's printed proceedings. Opportunities for self-instruction in all local branches of science—local geology, botany, natural history, and the like—were very few compared with what had been provided for English students. Here text books hardly existed, and English works were in many cases unsuitable. He would therefore ask the Society to consider whether means could not be devised for affording instruction of a more elementary and general kind, and he did not know of any other organisation so well qualified to do the work. He wished the rising generation to become more interested in the physical history of their native land, its fauna, flora, and so forth. The taste for such studies when once acquired rarely left a man, and developed afterwards along the lines of his peculiar preference, and thus the whole field of scientific enquiry became gradually occupied. He proposed for consideration the desirability of initiating courses of popular lectures on scientific subjects, under the auspices of the Society, not restricted to members, but open to all. He would like to see the Museum made use of on all occasions where its cabinets could be used as illustrations. Another thing which might be attempted in connection with the Society, was the formation of a Field Naturalists' Club. One other matter which might well interest the Society was the introduction of local science primers for school use. His chief desire was to supplement rather than subvert the work of the Society. For years science stood apart, its affairs were assumed to be above the popular understanding, but that had all been changed, and in Huxley, Tyndall, and many others they saw men of the highest scientific rank taking the lead in bringing their chosen studies home to the minds of the masses; consequently the Society need not fear that anything it might do would be *infra dig.* He hoped the love of science for its own sake would suffice to induce one or more of their savants to lecture, and permit the experiment to be tried. If the Council of the Society could keep an open eye for any opportunity that might arise to interest the public, and especially the young, he had faith that good results would follow.

NOTES AND EXHIBITS.

The **SECRETARY** drew attention to a rare bird that had lately been shot near Muddy Plains. It was commonly known in Australia as the "nankeen kestrel," *Tinnunculus cinhceroides*. Mr. Morton stated that it was a singular coincidence that in April 1875, two specimens now in the Museum, were shot at Sorell. On dissection the bird now exhibited proved to be a female. The habitat of this bird, as recorded in Dr. Ramsay's list, was N.W. Australia, Queensland, and Victoria.

Another specimen, "the golden plover," *Charadrius fulvus*, shot at the Great Lake by Mr. T. Clarke, as also a grebe, *Podiceps Australis*, shot by the same gentleman, was shown, having been shot at the Great Lake.

The SECRETARY also drew attention to a valuable collection of minerals from the great Broken Hill Mine that had been kindly presented to the Museum by Mr. F. Back, General Manager Tasmanian Government Railways.

Mr. J. R. MCCLYMONT, M.A., stated he had much pleasure in placing on record a new bird to the lists of birds at Tasman's Peninsula, the brown quail, *Synoicus Australis*. He also exhibited a specimen of native bread, with a peculiar fungus growing from the bread.

MAY, 1889.

The monthly evening meeting was held on May 14th. The President, His Excellency Sir Robert G. C. Hamilton, K.C.B., presided.

Mr. R. Price-Williams was introduced as a visitor.

OSCILLATION OF LAND AND SEA LEVELS.

Captain SHORTT, R.N., read a paper on "The possible oscillation of levels of land and sea in Tasmania during recent years." He referred to the earth tremors experienced during the years of 1883-86, prior to the Tarawera eruption, in this and adjacent colonies, and these phenomena being known to often be associated with local changes of sea and land, he was led to form the opinion that it was of great importance that it should be ascertained whether recent changes could be traced along the coast line of this island. Great difficulty naturally arose owing to the fact that with but one isolated exception no definitely fixed marks were in existence. This exception was a tide mark taking the form of a broad arrow on the Isle of the Dead, situate off Point Puer, Port Arthur. This mark was cut in the rock by Mr. Lempriere. He had made efforts to discover further records relating to Mr. Lempriere's observations, having applied to Mr. Wharton, Hydrographer of the Admiralty, but without success. By observations made in February of last year, it was apparent that there had been no practical alteration of the levels of sea and land during the past 47 years. This, however, only bore reference of a reliable character in so far as the southern portion of the island is concerned. Regarding the northern portion no reliable data existed, but it was interesting to note that Captain Miles had learned from the half-castes of the Furneaux Group that they had noticed an apparent decrease of depth of water over certain well-known rocks during recent years. He had taken steps to fix a tide mark on Flinders Island, permitting of observations being made in future, and urged the necessity of making such marks on various parts of the coast line of the colony.

CONGRATULATORY.

Mr. BARNARD desired, on behalf of the Royal Society, of which he was one of the oldest vice-presidents, to thank His Excellency for the part taken by him in that afternoon's proceedings relative to the new wing now added to the Museum building. He referred to the small beginnings in the matter of a museum first taken up by the Tasmanian Scientific Institution, of which Institution only two members —Dr. Agnew and himself—now remained alive. They then had an exhibition of specimens in a room in Macquarie-street without any attempt at classification. He congratulated the Royal Society on the progress made, and also the Museum Trustees on the fine addition to their building, for despite the fact that there were some persons who regarded the Museum and Royal Society as separate institutions, he could not in his mind separate them, for they had one object, the advancement and increase of knowledge. He also referred in congratulatory terms respecting the movement in the direction of an art gallery.

PAPERS.

THE ENGLISH AT THE DERWENT AND THE RISDON SETTLEMENT.

Mr. J. B. WALKER read a paper on this subject. He referred to a paper read by him last November on French visits to this colony and their supposed design of colonising it, and stated that the present paper would follow the course of English discoveries in Southern Tasmania. The English discoverer of the Derwent was Lieut. John Hayes, of the Hon. East India Co.'s Service. In those days the East India Co. claimed a monopoly of the trade, not only with India and China, but with the whole of the Pacific and New Holland. So late as 1806 the company successfully resisted the landing and sale in England of a cargo of oil and seal skins shipped by a Sydney firm, the ground being that it was infringement of their monopoly. Hayes' expedition was the only one ever sent by the company to assist in Australian discovery. Hayes was ignorant of D'Entrecasteaux's surveys, and when he came up the river in 1794 he thought it was an original discovery, and named it the Derwent. He also named Mount Direction, Prince of Wales Bay, Cornelian Bay, Risdon Cove, and other places. The vessel carrying Hayes' charts and papers to England was captured by the French and all his journals taken to Paris, and the result of his voyage was lost. The next visitors to the Derwent were Flinders and Bass, in the Norfolk. They circumnavigated Tasmania for the first time and surveyed the Derwent. Bass gave a favourable description of the country on the shores of that river, and was particularly struck with the advantages of Risdon. It was probably owing to his report that Governor King instructed Lt. Bowen to form his settlement there. The paper then proceeded to give the history of the Risdon settlement, principally from information contained in documents preserved in the English State Record Office, and which were lately copied by Mr. Jas. Bonwick for the Tasmanian Government. The first settlement in Tasmania was made on September 12, 1803, on the hill near Risdon, on which the house of the late Mr. T. G. Gregson stands, a most unsuitable site, as it afterwards proved. From the very commencement Bowen had great trouble with his people, the prisoners being of a very bad class, lazy, useless, and ill-behaved. The few soldiers who formed his guard were discontented and almost mutinous. A few weeks after Bowen's arrival a reinforcement of prisoners and soldiers was sent from Sydney, making the number up to about 100, but the new arrivals proved no better than the first. Very little in the way of progress was accomplished, and when Governor Collins arrived in February, 1804, he found no ground had been prepared for sowing. Prisoners escaped from the colony, and the soldiers robbed the stores. In February, 1804, Governor Collins abandoned the proposed settlement at Port Phillip, and brought his colony to the Derwent. He abandoned Risdon as unsuitable, and chose the present site of Hobart for his new town. Bowen was at the time absent in Sydney, whither he had taken a soldier to be tried for robbery. When he returned he found Collins in command at the new settlement in Sullivan's Cove. The little party at Risdon were in a sad condition, short of food, and altogether demoralised. Lt. Bowen was still left in charge of the Risdon colony, and on May 3, 1804, the first affray took place between the English and the aborigines at Risdon. The cause of this unfortunate occurrence was the arrival of 200 or 300 natives who had come to hunt kangaroo. They did not attack the settlers, but their appearance created a panic, which resulted in the soldiers firing upon the blacks, killing a number variously estimated at from three to 50. This was the beginning of the troubles with the natives which lasted for nearly 30 years, and ended in the almost complete destruction of the native race, and the removal of the remnant to Flinders Island. In May 1804 the Risdon settlement was abandoned, and all the soldiers and the prisoners comprising it, except about a dozen were sent back to Sydney in the month of August. Lieut. Bowen's pay for 14 months governorship was 100gns. He returned to England, and as captain of an English man-of-war, served during the later years of the French war, dying in 1828.

OPINIONS OF A VISITOR.

Mr. PRICE-WILLIAMS expressed the deep interest he had felt in the papers read that evening. He was of opinion that the suggestion respecting the recording of the earth's changes and the relative levels of the earth and sea should be given effect to in all parts. It was highly gratifying to find to what extent the scientific efforts were carried in this colony.

THE IRON BLOW AT THE LINDA GOLDFIFLD

. Mr. R. M. JOHNSTON read a paper on this subject, in which he set forth that the differences of opinion as between himself and Mr. Thureau, fortunately, were not of a serious nature, and, according to Mr. Thureau's recent explanation, he perceived they were more due to the confused way in which descriptive terms were employed than to any real differences of opinion. The question between them had been altogether misconceived by Mr. Thureau. If Mr. Thureau had discussed the Iron Blow question without confusing these two fundamental considerations it would have placed the issues between them in a very small compass. In the course of the paper he contended that the fissure at the Linda was originally caused by the same dynamic forces which caused the tilting, folding, and metamorphoses of the crystalline rocks, and that those mighty effects were primarily caused by the gravitation of the outer crust towards the shrinking and cooling central mass of the earth. Mr. Thureau's reply firmly established his opinion "That the four principal elements—iron, barytes, sulphur, and gold—were originally precipitated from solution." That both decomposition and recomposition in mineral veins are among the most common of all occurrences and cannot reasonably be disputed; and finally that true mud volcanoes differ widely in characteristics from the phenomena associated with the Linda Iron Blow, and neither in their mode of appearance, nor in their characteristic contents, show the slightest correspondence with the metalliferous fissure lodes of the Linda district. Further discussion was postponed till the June meeting.

COMPLIMENTARY.

Votes of thanks to the writers of papers, closed the proceedings.

JUNE, 1889.

The monthly evening meeting was held on June 11th. The President, His Excellency Sir Robt. G. C. Hamilton, K.C.B., in the chair.

NEW MEMBERS.

The following gentlemen were balloted for, and declared elected as Fellows:—Messrs. H. Herbert Oakley, Chas. E. Walch, Howard Wright, John Mitchell, and Geo. Lightly.

LARGE AUSTRALIAN TREES.

The Secretary (Mr. A. Morton) read the following letter, under date 26th ult., received from the Hon. F. Stanley Dobson, Melbourne:—

My Dear Sir,—Instigated by Oliver Wendell Holmes, I have been trying to get ascertained the actual height of our tallest gum trees. Baron von Müller in his "Botanic Teachings" speaks of 500ft.! In our recent Exhibition was the photo of the butt of a tree called "The Baron," which was stated, as per note thereto annexed, to be 464ft. measured. I gravely doubted this, and I arranged with the Hon. Jas. Munro, who was appointed with myself to control and appropriate the expenditure of £100 from the trustees of the Public Library; £100 from the Commissioners of the recent Exhibition, and any further sum up to £800 that might be necessary from our Lands department—to have this specially-named tree measured and photoed. Mr. Munro advertised a reward of £100 from his own pocket for any one who would point out to a licensed Government Surveyor a tree reaching 400ft. Mr. Munro and I obtained through the Hon. Mr. Dow, Minister of Lands, reports from the surveyors in his department as to any exceptionally large trees within their knowledge. The highest turned out to be a tree near Ueerim, in Gippsland, which reached (I am speaking from memory) 325ft., at any rate it was the largest that our surveyors and photographers could get at. "The Baron" was known only to a Mr. Boyle, and to a photographer, Mr. Carie, the gentleman whose photo of the butt appeared in our Exhibition. Mr. Carie would not say where it was, so I wrote to Mr. Boyle, and he consented to guide anyone whom I choose to send to the tree. I saw Mr. Perrin and Mr. Dow, and it was arranged that Mr. Perrin and Mr. Fuller, a Government surveyor, should arrange to go with Mr. Boyle to the spot. They went, and when Mr. Perrin saw that the trees on the Sassafras Valley were very tall, he set four men to work to clear the scrub and undergrowth away, so as to allow both a theodolite and a camera to work on "The Baron," and to other trees in the neighbourhood. Allowing time for the clearing, he returned with surveyor and photographer, and we now find that the "Baron" instead of being 464ft. is only 219ft. 9in. No tree in the neighbourhood reached 300ft. Now, I believe that your Tasmanian trees beat ours, and as I am most anxious to set the matter finally at rest, I am writing to you and through you to the members of the Royal Society to get, if I can, verified statements of the height of Tasmanian trees. I remember that Sir William Denison measured some trees near the Huon, and in one of the Tasmanian Exhibitions the printed catalogue, unless my memory fails me sadly, was contained his measurement of the tree, and a further statement of the number of 8ft. and 6ft. palings, the number of shingles and laths cut out of it, and the price which this timber realised in the Melbourne market—something like £250, as our first goldfield rush was then at its height, say, 1853 or 1854. Sir William's tree reached, I think dimly, 290ft. before a branch was given off and then ran up some 50ft. or 60ft. more. Now, I want to ask you to turn up this record and to let me know the results. You must have other records of big trees—some which were cut down by the convicts near Port Arthur must, I believe, have exceeded any record I have seen, and probably none remains. This is a matter of Australian interest, and I feel sure that your Society will aid us now that we are trying—with sufficient funds at our back—to find out the height of the tallest gum-tree in Victoria. It is humiliating to have to give up the idea of the 500ft. tree of which the Baron V. Müller wrote, but the close investigation now going on will serve to give us data from actual measurement, and not from the excited fancy of bush explorers. If you can assist me in this matter I shall be very grateful.

Mr. **Swan** stated that the late Anthony Trollope had expressed the opinion that the Victorian trees equalled in height those of America. His own personal observations had, however, been only in regard to girth measurement.

Colonel **Legge**, R.A., expressed the opinion that it would be well if the Government would assist in the matter of obtaining reliable information as to the height of their forest trees. Doubtless great misapprehension existed on this subject. Personally he had never seen any trees which exceeded 250ft. in height.

Mr. C. H. **Grant** expressed the opinion that the Maraposa and Calaveras trees were larger than those of these colonies.

Mr. **Mault** explained the method in which the height of trees might be easily ascertained. He thought the maximum height brought under his notice was about 283ft.

PAPERS.

ANGORA GOAT FARMING.

Mr. **James Andrew** read a paper on this subject which had not come under the notice of the Society since 1874, when an effort was made to stimulate popular interest in favour of a trial in this colony of a description of stock-farming, elsewhere found so profitable. This, however, has proved ineffectual, and it was a regrettable matter that mohair (the fleece of the Angora goat) was absent from the list of our exports. In Asia Minor, the natural habitat of the Angora goat, the present value of hair exported from the province amounted to £200,000 per annum. Col. Henderson was the first introducer of the goat in the Cape Colony, and from an export of 1,036lbs. in 1862 up to 1887 the trade had grown to 7,154,000, of a value of £268,500, a fall of 1d. per lb. on the preceding year's clip. An additional item of export was the skins, valued at £100,000, and even these figures failed to represent the total value of the products of this useful animal, for the flesh of the wether had been proved to be an excellent article of food. Latest returns from the Cape showed the number of Angora goats in the colony to be two and a-half millions. Mr. Scott, Minister to Turkey in 1848, was the introducer of the goat into America, but the industry had not equalled the South African. As an evidence of the market which existed for the fleeces he quoted from the Tariff Commission of the United States, in which it was stated that—"The supply produced in the States, if multiplied threefold, would not be sufficient to furnish material for the plushes now used in the railway cars of that country alone." The history of the endeavour to establish the industry in Victoria had not been very satisfactory. It was feasible to cross with the common goat the fleece of the fourth generation, pure sires being used being equal for market purposes to that of the pure-bred; 5lbs. might be taken as a fair average of a well-kept grade flock shorn once a year. Any staple of over 4in. in length would suffice for manufacturing purposes. Shearing in South Africa was usually conducted in a somewhat slovenly manner, and sorting but inefficiently carried out. Some trouble arose at kidding time, owing to the helplessness of the young, and the want of strong maternal instinct on the part of the dams. The trouble and expense of managing the flock would be less than in the case of sheep, goats being the more intelligent, and less liable to destruction by dogs. Their attachment to home enabled dependence to be placed on their return at night. Their introduction would not encroach on the pasturage available for sheep ; indeed, the reverse, for Angoras had been found to be excellent pioneers in clearing up new country for sheep and cattle, and were positively a benefit to other stock, especially sheep. An immense amount of land now valueless could be utilised for good farming, and an important fact was that they did not appear subject to dietetic influences such as were sheep, and appeared to suffer no inconvenience from being depastured on country where plants abound which, when eaten by sheep, prove fatal. The climate of Tasmania and Australia had been proved to be peculiarly suitable for goat farming. Islands were specially adapted for farming goats, and one he could recommend for tentative occupation was West Hunter Island, to the north-west of Tasmania, in Bass Straits, obtainable on a 14 years' lease from the Crown for £20 per annum, and which was unsuitable for sheep-farming, as the poisonous tare—*lobelia*—of King's Island abounded, and invariably proved fatal. If it was found that the goat enjoyed immunity from the evil effects of the plant an illimitable scope for goat-farming was opened up on the unstocked islands of the Straits. The stock regulations at present in force prevented the importation of goats from any place outside Australasia, but prize-bred Angoras could be obtained in neighbouring colonies where small flocks are maintained. He had made enquiries to ascertain particulars of the Angora goats still remaining in the colony, but these had proved unsuccessful. Possibly the non-success of previous attempts at goat-farming here might be attributed to the fact that the goats had been kept on an open grass country, clearly a mistaken policy : rough, mountainous, and scrubby country being far more suitable.

Mr. **JUSTICE ADAMS** pointed out that between Latrobe and Ulverstone there was a considerable flock of Angora goats in existence. He could not say if they were pure breds. He estimated the flock to number between 50 and 60 animals. He had also seen another flock of these goats, but could not call to mind the exact locality.

Mr. **JAMES BARNARD** confirmed what had been mentioned by Mr. Justice Adams. The flock was owned by Mr. James Smith, of Westwood.

Mr. **A. J. TAYLOR** suggested that the secretary should communicate with Mr. Smith for the purpose of obtaining information on the subject.

CHILD POISONING BY EATING THE TRUMPET LILY.

Dr. **HARDY** read a paper describing a recent case of poisoning occasioned by a child eating a portion of the common trumpet flower—*Brugmansia sp.* The plant he pointed out was allied to the Solanacia family, known to be poisonous. He treated the case in question with success, but concluded the paper by directing attention to the desirableness of an investigation of the qualities of Australasian flora from a medicinal point of view, respecting which at the present moment but little is known. He had little doubt that if this was done the result would be the discovery of remedies for diseases which might be classified as having become peculiarly localised—as for instance typhoid fever and cancer.

Mr. **Ward** supported the suggestion contained in the concluding portion of the paper. He purposed making an examination of the plant which had been eaten by the child treated by Dr. Hardy.

THE IRON BLOW: LINDA GOLDFIELD.

Mr. **Ward**, in continuation of the discussion already opened, in which he maintained that the composition of the Iron Blow completely showed that they were not of volcanic origin, as such materials were seldom found in masses such as in the present instance. This, with the exception of specular iron which is occasionally of volcanic origin. He laid particular stress upon the presence in all of them of peroxide of iron and pyrites, from which, he asserted, was derived the large proportion of sulphate of Barium. He also contended that Mr. Thureau was incorrect in contending that the presence of gold in small quantities was to be taken as evidence of volcanic origin.

Mr. A. J. **Taylor** produced specimens obtained from the Iron Blow, and pointed out that he considered the papers read by Messrs. Ward and Johnston had fully established the nature of the present case. He believed the plain inconsistencies in Mr. Thureau's paper were attributable to that gentleman's mistaken estimation of the value of various equivalents of the English language.

DISCOVERY OF FOSSIL FISH.

The **Secretary** stated that at the next meeting, in conjunction with Mr. Johnston, he would lay before the Society a paper on the discovery by an enthusiastic collector—Mr. Nicholls—near Hobart, of a fossil fish. The specimen, which he placed on the table, and which had been secured for the Tasmanian Museum, was, he believed, the first discovery of its nature in the colony.

AUSTRALIAN TURQUOISE.

Mr. A. J. **Taylor** exhibited a beautiful specimen of turquoise, the latest found in Australia of a mineral suitable for jewellery purposes, obtained at Wangaratta.

COMPLIMENTARY.

In moving the customary vote of thanks to the authors of papers, His **Excellency** mentioned that Mrs. Meredith had added her experience to the effect that the Angora goat could be successfully farmed in this colony, and would thrive where no other animal would. He referred in complimentary terms to the other papers, and the vote having been passed the meeting terminated.

JULY, 1889.

The monthly evening meeting was held on July 9th. The President, His Excellency, Sir Robert G. C. Hamilton, K.C.B., presided, Lady Hamilton was also present.

Mr. F. Back, General Manager Tasmanian Government Railways, was elected a Fellow of the Society.

TASMANIAN TREES.

CORRESPONDENCE.

Bell-street, Domain, Hobart, June 12, 1889. Dear Sir,—By this morning's *Mercury* I observed an interesting letter from Mr. F. Stanley Dobson, referring to what steps had been taken in order to ascertain by careful measurement the height of forest trees in Victoria. We have very little reliable evidence as to the exact height of the tallest Tasmanian trees. Some years ago, the Rev. T. J. Ewing, of the Orphan Schools, New Town, was engaged under the authority of the Government to compile a short paper on the statistics of the colony, wherein was mentioned the measurement of several trees of exceptional size, but none (trusting to my memory) reached 300ft. One was stated to be 240ft. to the first branch, where the tree had been broken off by wind, and the remaining portion guessed at 50ft. or 60ft., therefore the true height was left still conjectural. Many years ago I accompanied the late James Sprent (Surveyor-General) up the spurs of Mount Wellington, where it was thought the tallest trees of Tasmania would be found. We, however, did not meet with anything like 300ft. We measured the root of a large stringy bark (*E. Robust*), and ascertained its circumference to be 14ft. close to the butt. On my own farm, Circular Head, I had a tree felled away from the house, upon which I placed the 2ft. rule, and found the height to be 218ft. 6in., 12ft. at the butt in diameter. About 24 miles south of Stanley, Circular Head, I met with at the foot of a steep hill, near the banks of the River Arthur, a bed of trees of extraordinary height, where some might possibly reach 300ft. There are exceptionally large and tall trees at Table Cape, North-West Coast, growing all along its summit and in the deep gullies, attaining great height, but whether above or below 300ft. could only be ascertained by proper tests. I employed splitters at Circular Head who produced 13,000 and 11,200 5ft. palings from two trees, some of which were sold at Melbourne at the rate of 105s. per 100, 1852 and 1853. It would be very interesting if the Royal Society of Tasmania took steps to procure authentic statements of the height of our forest trees, and to clear up as well the statement that the trees of Tasmania in their growth make two rings every year; upon one occasion I put it to the proof by cutting down a young sapling 16 years after it had been planted, and found 16 rings only. I think the age of our trees has been much exaggerated, and that the true time of growth is far less than is generally supposed. I cut a tree at Piper's River evenly with the crosscut saw, and found 151 rings distinctly visible; its height was 155ft., and thickness when felled 5ft. 2in. and 4ft. 10in., or about a mean of 5ft. I refer you to Ainsworth's "All Round the World," 1st and 2nd vol., for photos. of giant trees of Sonora, 460ft. high.—Yours truly,

S. B. Emmett.

Dear Sir,—Having read the enclosed slips which appeared in our paper, and observing your name mentioned in one of them, I take the liberty of telling you that I discovered a clump of trees (silver topped stringy bark we call them) some 15 years ago under the south end of Mount Barrow. Having noticed in Sturt's map a patch marked "impenetrable scrub" I had the curiosity to force my way through it, and so found the trees in question. As well as I can remember, there may be about a hundred of them, one being 33ft. through by actual measurement with a tape, and, I should judge, 400ft. high. The others are all about 20ft. to 25ft. through, and as square as a dry goods box, and would split like matches. None of them, except the large one, have a blemish of any sort, but run up hundreds of feet without a bough. The large tree is burnt through, there being a passage wide enough for a man to walk. The first time I saw it I could only measure it by pacing, but a few days afterwards I got two of my brothers to go up with me, taking a tape, and we then found its actual measurement as stated above. In all my travels about Tasmania, prospecting and otherwise, I have never seen a tree to compare in any way with this colossus, and it is worth going a good way to see. I often think of these trees and endeavour to form an idea as to how many palings one of them would split. I may say that I was one of the Government party that cut and surveyed the track through the great Gippsland scrub from Moe to Stockyard Creek and saw some big trees, but none to compare with the one in question, Apologising for trespassing on your valuable time.—I am, dear sir, yours very truly and obliged,

CHAS. B. BARKLEY.

A letter from Mr. A. Johnston, addressed to Colonel Legge, was also read, wherein he directed attention to having brought under Colonel Legge's notice some years since a tree measuring 295ft.

SELF-REGISTERING THERMOMETER.

Captain SHORTT laid before the Society a chart showing the registration of temperature by a self-registering themometer recently received from Paris. He explained that the instrument did not move by means of spirit or mercury, but on an entirely new principle, *i.e.*, the expansion of a curved piece of brass.

TERRA AUSTRALIS.

Mr. MCCLYMONT read a paper on the misconception existing in earlier times on this subject. He dealt with the probable discoveries made by early Portuguese and French voyageurs.

OLD TASMANIAN CHARTS.

Mr. MAULT apologised for his inability to lay his paper on this subject before the Society at that meeting.

Mr. MCCLYMONT explained the circumstances which had given rise to inquiries being made respecting charts captured from Captain Hayes by the French.

THE TRUMPET FLOWER.

Mr. WARD related the results of recent analysis of a portion of the plant mentioned by Dr. Hardy at the last meeting. He had discovered only a small trace of atropine present.

SMUT IN WHEAT.

Mr. Joseph **Barwick** contributed the following paper on this subject to the Council of the Royal Society of Tasmania, and it was read by the Secretary at Monday night's meeting. In his paper Mr. Barwick said :— My apology for addressing this paper to you is that we have no Farmers' Club in Tasmania, or experimental farm, and my object is to ask that a small space in your Botanical Garden may be granted to test the cause of smut under your manager ; but before asking for this unusual concession it is due to you that I should explain a few of the tests that I have practised for the last 15 years. It is a fact that this pest has hitherto defeated all attempts to discover the cause, which I can fairly claim to have discovered, and it was in this way. In 1873 I had a small paddock to sow with wheat, which I sowed with wheat threshed by steam machine, but in completing the sowing I had not sufficient dressed, as we term it, with blue stone, and I took sufficient from a bag, which I sowed without dressing. The result was that only about 25 per cent. of the dressed wheat came up, but that which was sown without dressing produced upwards of 80 per cent. of plants ; but upon the wheat coming to maturity I found that there was no smut in that which was dressed, but that the small piece sown without dressing contained more than 60 per cent. of smut. I then measured a square rood of each, and counted the plants which had produced perfect wheat, with the result that the number was nearly as possible equal, which at once struck me that the dressing had simply destroyed that which would have proved smutty. This induced me to enter into further tests the following year, which I applied as follows :—(I must explain that in those days it was not safe to sow wheat threshed by steam, consequently we used to get sufficient threshed by hand for seed.) I rubbed out 200 grains of wheat from stock which we were then threshing. I took another 200 grains of that threshed by steam, 200 do. threshed by hand. I divided these into two equal parts of 100 grains each. The first division I dressed with bluestone, the other division I planted without dressing, with the following result of that which was dressed :—No. 1. The 100 grains rubbed out by hand produced 96 plants of perfect wheat. No 2. Threshed by flail, or what is called hand-threshed, produced 81 plants of perfect wheat. No. 3. threshed by steam, produced 60 perfect plants. I will now ask you, gentlemen, to mark the result of that which was not dressed. The 100 rubbed out by hand produced 98 perfect plants and no smut. That threshed by hand produced 90 plants, 81 being perfect and nine smut. That threshed by steam produced 81 plants, 50 being perfect and 31 smut. This result confirmed my previous experience that it was the damaged grain that produced smut, and that the dressing simply destroyed these grains and prevented them from germinating, but I did not stop here. I planted other beds with samples threshed as described, and took up the plants as soon as they came out of the ground, and I discovered that these damaged grains, unlike perfect ones, came to the surface before shooting any roots, and that the roots when they came they differed from the perfect roots by spreading in to a delicate form near the surface, instead of a strong, healthy, root penetrating downwards, and during one test I divided my plot, and by trying the plants with the finger and thumb upon one half of the plot, and taking out those that came too readily I succeeded in taking out all the defective plants but one, as shown when the wheat ripened, for I had only one smut plant left when in the other half, I had 31 smut plants. I have followed up my tests from year to year with the same result, and have never produced a smut plant from grain rubbed out by hand, and not injured, and I have come to the conclusion that smut is the result of defective rooting of these damaged grains, and if my contention proves correct an enormous saving can be effected by introducing machines coated with gutta percha, including loss of time, cost of bluestone, and destruction of wheat would amount to a saving of fully 3s. per acre, but there are other causes of smut quite beyond the control of man, another strong proof that I am correct, and that is atmospheric influence; for instance, the past season was most prolific in smut, and in every case I found it was upon the high lands, it being too dry to allow the roots to penetrate to a sufficient depth to mature the grain. I found during the last season heads one half smut the other half perfect wheat, and in one case one grain half smut and the other half contained flour, and in all cases the upper half is the smut. Again, in the very wet season smut may be found, but it will be found in the low and wet portions of the field, the root having been injured through too much moisture. Our grasses often prove smutty, but it is only the annual variety that can be found smutty. The perennial plant has established the roots to a sufficient depth to mature. I have read, from time to time, the theory that smut is caused by infection in the stack, and, giving as a proof that self-sown or shook wheat is never found smutty. The truth is that this self-sown grain is not subject to injury in threshing, and will support my experience with reference to infection. I have, upon several occasions coated wheat that I had carefully rubbed out of the head with smut dust, but have never produced a smut head from sound grain. I hope the tests explained have had the effect I desire of interesting you in a problem that has hitherto baffled all attempts to solve. To permit some tests to be carried out in your gardens under your manager, I will undertake to supply seed prepared in various forms for the test and numbered. I am sure the tests would be interesting. Again apologising, gentlemen, for bringing under your Society what very properly should have been a farmers' subject to deal with.—I am, etc.,

JOSEPH BARWICK.

The Secretary intimated that the suggestions would be laid before the Trustees of the Museum and Botanical Gardens.

The President, in moving the usual vote of thanks to the contributors of papers, expressed the hope that something would be done to meet Mr. Barwick's suggestions.

AUGUST, 1889.

The monthly evening meeting was held on Monday evening, August 19th, the President, His Excellency Sir Robert G. C. Hamilton, K.C.B., in the chair.

THE LATE MR. JUSTIN BROWNE.

The PRESIDENT said: Gentlemen, before we proceed to business to-night I would remark that since our last meeting this Society has suffered the loss of a very old member who had been, I understand, 21 years a member of the Council—Mr. Justin McC. Browne. I am sure we should wish to place on record our great regret at his death, and our heartfelt sympathy with those he has left behind.

TALL TASMANIAN TREES.

The SECRETARY (Mr. Alex. Morton) stated that since the last meeting, at which the question of the height of some of the tallest Tasmanian trees had been discussed, he had been making inquiries by circular on the subject and had received some replies of value thereon. He intended to have a paper on the subject at a future meeting of the Society. Baron Von Müeller had written on this subject asking him to mention at this meeting that he (Baron Von Müeller) had never made himself responsible for measurements of 400ft. in height of any eucalyptus trees, and that in nearly all his writings on this subject he gave the names of those on whose statements he had relied too hastily in reference to exaggerated data concerning the supposed exceptional heights of certain eucalyptus. In the *Argus* of May 25 last he had set forth some of the best information obtainable, and urged new measurements of trees in Tasmania and West Australia. It would be pleasing if the Tasmanian members of the Australian Association for the Advancement of Science, who will attend the Melbourne meeting to be held in the early part of next year, could furnish for the biological section genuine measurements of Tasmania's tallest trees, or trustworthy records of past discoveries in this direction. He further suggested that an officer from the Survey Department should visit the group discovered by Mr. C. Barkley at Mount Barrow to obtain reliable data on the height of these trees.

Mr. T. Stephens furnished the following memorandum on the subject of Lady Franklin's tree :—

In June, 1881, I measured the trunk of a large tree near the Huon road, which had gone by the name of Lady Franklin's tree, and was probably identical with one of those described by the Rev. T. J. Ewing in the proceedings of the Royal Society of May 9, 1849. It had been blown down in the gale of December 26, 1880, and had been partly burnt in a bush fire some two months afterwards. The circumference of the trunk at the ground was about 70ft., but measurements round the buttresses of these large trees are not worth much for purposes of comparison. At 26ft. from the root the circumference was 27ft., and at 56ft. up it was 21ft. The total length of the stem to where it ended abruptly, being free from branches the whole way, was 266ft., and it was there 9ft. round. Sixty or seventy feet is a very moderate estimate for the height of the rest of the tree, and the total height could not be less than 330ft., and might have been much more. The tree was too much burnt to enable one to determine the species, but Mr. Ewing calls his big tree a swamp gum. My impression at the time was that the greater part of the top had been blown off, as often happens, long before the tree fell. More remains of it would have been left if it had been down only six months.

In reply to the President, Mr. **Stephens** said this tree was lying about eight miles from town. He did not know whether any portion of it remained. This would, of course, greatly depend upon what bush fires had happened in the locality.

Mr. **Johnson** directed attention to the remains of a great tree lying near the coal mines at Snug. Proofs of the huge size of this tree were easily traceable in the decayed remains. It was a very remarkable tree.

ANGORA GOAT FARMING.

The Secretary of the Royal Society stated at its last meeting that he had written to Mr. James Smith, Westwood, mentioned in the discussion which took place at the May meeting, on a paper on this subject, and that gentleman had furnished the following particulars:—

The Angora goat will, I believe, thrive in Tasmania, if not too much exposed to the inclemency of the weather, and if not stinted in its food. A pure Angora buck which I had in my flock for several years, and which did not receive any special care, seemed as hardy as a common goat and his successor in the flock seems to possess equal endurance. Having brambles ("black-berries") on some of my land, I was first led to keep "grade" Angoras, after the trial of the browsing habits of a pair, from my attention having been directed by a neighbour to the fact that a common milch goat kept by him had destroyed a number of brambles, which had become a nuisance, by feeding on their leaves and buds. When Angoras have the choice of brambles and abundance of grass, they seem to prefer the grass while it is green, but turn with evident relish to the brambles when the grass becomes withered or scant. For the better eradication of brambles by goats they should be cut low, or so reduced by burning that their young shoots may be eaten off close to the ground. It is hardly necessary to say that brambles are in many places in Tasmania beginning to encumber the ground to an objectionable extent. In destroying brambles my "grade" Angoras have been very useful, though their usefulness in this respect has been limited from the necessity of specially erected fences, with little exception, to prevent the goats from straying. The Angora goat is, like the common goat, very prone to wander, and therefore unusually close fences are necessary where it is requisite to limit the range of the goats' movements. I have seen a grade Angora in passing from an enclosure, ascend a stump and spring from it to the top of a post of a five-rail fence, and then to the ground, and when hunted it has quickly found a log from which to recross the fence in a similar manner. The first, so-called, Angora goats that I obtained were not quite pure. In order to ascertain the value of their "mohair" I sent a small quantity of it to London, where it sold at 1s. 4d. per lb., when ordinary Merino wool was selling at 10d. per lb. I was afterwards informed, however, by the Messrs. Sait, who, it is understood, manufacture mohair, that similar mohair was not worth more that 1s. per lb. It seems from my observation in the matter that by crossing with a pure Angora buck and well selected common goats, a hardy race, which begins at once to exhibit the qualities of the sire in a remarkable degree, is produced. The following extract in reference to the selection of a "stock buck" is from the *American Agriculturist* for April, 1876:—"1st. Pedigree dating back to ancestor imported from Asia. 2nd. Weight of long silky, ringletted, white fleece, and its freedom from kemp and mane on the back and neck. 3rd. Form, size, and vigour." There is an illustration in two skins which I am sending to the Hobart Museum of degrees of breeding. It will be observed that the skin from which the ears have not been removed has a better fleece than the other. The latter skin is from a goat less pure than the former. The following extract is from an article on "Goat keeping" in the *American*

Agriculturist for 1878:—"The profit from the goat can come only from the skin and hair. A large quantity of goat skins is yearly imported for tanning to produce Morocco leather, and the hair of the common goat is valued for the plasterers' use. The Angora goat bears a fleece of mohair that is valuable for several manufactures. . . By crossing with Angora males the common goat can soon be bred up to a point where the fleece is worth as much as that of the pure bred. . ." The goat will thrive where the poorest sheep would starve, but it better enjoys the rough fare of rough places than the sweetest pastures of grass. There are many rocky and half-barren localities that might be put to good use by being turned into goat pastures and there are many better pastures ill-fitted for the less hardy sheep upon which goats could be successfully kept. As to the yield of mohair from each well-bred grade Angora, I am of opinion that this would be from five to eight pounds, though I cannot speak positively as to the yield, as my Angoras usually lose a portion of their hair from coming in contact with brambles. It has been thought that as the hair of Angoras will grow to the length of 4in. in six months they might be shorn with advantage twice a year. But in any case of shearing Angoras or grade Angoras, care should be exercised that they be not exposed to an injurious extent to cold weather. In this respect nature seems to indicate by the commencement of the shedding of the hair, when the shearing can be performed with the greatest safety.

The following extract is from *The American Agriculturist*, for November, 1876:—"In California and other of the Pacific States large flocks of grade Angoras are being bred for their skins, for which there is an increasing demand in San Jose, California, by the Angora robe, glove, and mat manufactory. The carcase is highly prized wherever introduced as food, while the milk is highly esteemedfor domestic use and the sick-room." To recur to the usefulness of goats in destroying brambles—and a single goat will do much in this respect—if herded on brambles goats will not thrive on these alone, but would require an amount of hand-feeding in the absence of sufficient grass within the enclosure. The food to be given by hand might consist of waste from the kitchen, such as turnip tops and cabbage leaves, with other things easily available on a farm. I cannot, from my own experience, disagree with the statement in the concluding portion of a paragraph in *The American Agriculturist* for October, 1878, that "There is nothing in the goat or fleece to make it preferable to sheep, excepting under circumstances in which sheep cannot be kept profitably." Goats could be kept with advantage with sheep, in some instances, as they would eat much that sheep would not, and so would tend to prevent the spread of some of the plants that are injurious to the growth of grass. For fuller information on the Angora, the *American Agriculturist* for February, 1887, refers its readers to the book, "The Angora Goat," by John L. Hayes, LL.D., price 1·50dol.

Mr. JOHNSTON stated that Angora goat farming had been carried on in Perth for many years, the hair being made into articles and sold in Launceston. It would not be necessary to go further afield than this for information on the question of whether the goats would thrive in the island.

Mr. JUSTICE ADAMS said he had made inquiries respecting the flocks observed by him between Ulverstone and Fermby, and was informed they were owned by Mr. Jas. Smith and Mr. Templar, a neighbour of his. Mr. Templar's flock were kept on very poor ground, which bore out Mr. Smith's observations that poor land would suffice for farming purposes. He had also been informed that, an inquiry from a resident in a neighbouring colony as to the price of a kid had resulted in a sum of £2 10s. being asked. There were several large tracts of land too poor for sheep growing which could be utilised for goat farming.

OLD CHARTS OF TASMANIA.

Mr. Mault read a paper dealing with certain old charts captured from Captain Hayes by the French, and now lodged among the archives of France, but copied by the permission of the Government of that country. The paper dealt at length with each of the charts, and illustrated the origin of many of the original names of the Derwent and its surroundings.

Mr. McClymont complimented Mr. Mault on the care bestowed on his paper, and reviewed the earlier part of the voyage of the Marion.

Mr. Walker also spoke on the paper, quoting from the Brabourne Papers to illustrate the possibility that Flinders at the time of his detention at the Mauritius was carrying despatches from Governor King, which were regarded by his captors as a violation of the passport held by him from Bounaparte.

DISCOVERY OF A FOSSIL FISH.

Mr. R. M. Johnston read a paper, the joint production of Mr. Morton and himself, respecting the recent discovery by Mr. H. Nicholls of a fossil fish, presented by him to the Museum. The specieshad been named *Acrolepis Hamiltoni*, in recognition of the deep interest always observed by the President in the affairs of the Society.

The Secretary read a communication from Mr. Petterd, referring to a fossil fish discovered by him in a quarry near Knocklofty 18 years back, but which had not been described, but had been lost.

Mr. Stephens referred to certain correspondence received by him from Professors Stephens and McCoy asking for particulars of this discovery.

AUSTRALIAN AND TASMANIAN SANDARACH.

The Secretary read a paper by Mr. J. H. Maiden, F.L.S., F.G.S., Curator, Technological Museum, Sydney. In it the writer referred to the fact that a specimen of resin from the Oyster Bay Pine of Tasmania, sent to the Exhibition of 1851, first drew the attention of experts to the possibilities of Australian Sandarach. For this exhibit and other gums and resins, Mr. J. Milligan was awarded honourable mention. Sandarach is one of the most valuable of Australian and Tasmanian vegetable products, a market is ready for it, and it seems strange that it should have been so long neglected. No statistics are available in regard to the importation of Sandarach into these colonies, but to bring it here at all is a veritable "carrying of coals to Newcastle." In various parts of Australia and Tasmania there are vast numbers of *Callitris* trees, and their resin, often abundant, can readily be collected, and the author is sure that even with the cheap labour of Northern Africa to contend against, it can be profitably gathered during a portion of the year. The approximate price of Sandarach in London, is 60-115s. per cwt., and there is no difference between it and the colonial article. As to the cultivation of the trees, Baron von Müeller states, "Probably it would be more profitable to devote sandy desert land, which could not be brought under irrigation, to the culture of the Sandarach cypresses, than to pastoral purposes, but boring beetles must be kept off. It is also to be borne in mind that *Callitris* timber is valuable."

Mr. Stephens referred to the manner in which these trees were destroyed in clearing for sheep farming.

The President said he had frequently noticed the destruction of these trees.

COMPLIMENTARY.

The President moved the usual vote of thanks to the contributors of papers.

SEPTEMBER, 1889.

The monthly meeting of the Royal Society was held on Monday, September 9th. The PRESIDENT (His Excellency Sir Robert G. C. Hamilton, K.C.B.) presided. Mr. J. Provis, of South Australia, was elected a corresponding member of the Society; Mr. Chas. Guesdon a member.

The PRESIDENT desired to bring a matter concerning the young salmon now at the Salmon Ponds before the Society. These were the undoubted product of the ova brought out by Sir Thomas Brady, which had been stripped from the male and female fish and artificially fertilised, and the utmost care had been taken to keep them apart from any other fish bred in the Ponds. He recently visited the Ponds, accompanied by the Chairman of the Fisheries Board, the Secretary, and two of the members, when they carefully examined a number of the young salmon, among which they were surprised to find marked differences existing, not only in size, but in their characteristics. It has often been held that the *salmonidæ* caught in Tasmanian waters cannot be true *Salmo salar* because so many of them have spots on the dorsal fin, and a tinge of yellow or orange on the adipose fin, but nearly half of the young salmon they examined, which had never left the Ponds, had these characteristics. Again, many of them were almost "bull-headed" in appearance—another characteristic which is not supposed to distinguish the true *Salmo salar*. He would suggest to the Chairman of the Fisheries Board, whom he saw present, that the Secretary should be asked to make a formal report of the result of this visit, and to obtain some specimens of the young fish, which could be preserved in spirits, and perhaps sent to Sir Thomas Brady to be submitted for the consideration and opinion of naturalists at Home.

Mr. ALLPORT directed attention to the desirableness of placing young fish in the West Coast rivers, which were entirely free at present of fish of a migratory character.

Mr. JOHNSTON pointed out the difficulty of transit in stocking these rivers. He thought Lake Dixon would afford an excellent home for the salmon, equal to any of the Scotch waters; and as it is one of the affluents of the Franklin and Gordon Rivers, the young fish would find their way to the Western Ocean.

Mr. MERTON drew attention to a specimen of the fish referred to, one that had been bred from the late shipment of ova brought out by Sir Thomas Brady. The fish exhibited had no markings on the dorsal fin, but, as had been stated by His Excellency, there appeared to be quite an equal number in the pond with markings on the dorsal as those without. He hoped the recommendations of His Excellency, that specimens of this young fry should be sent to some of the leading ichthyologists in Europe for their opinion would be carried out, because from the care and attention bestowed on the late shipment of ova there could be no question but that the ova was from the true fish, *Salmo salar*.

SMUT IN GRAIN, AND DEPOSIT OF SALT.

The Secretary (Mr. A. Morton) read the following correspondence rom Mr. Joseph Barwick, relating to smut in wheat, and also to a large deposit of salt found on the plains near Mona Vale.

"To the President and Council of the Royal Society of Tasmania. Gentlemen,—After reading the two high class, and what would seem unanswerable papers upon the above subject, read at the last meeting of your Society, it will seem presumption for me to again trespass upon you. However, I respectfully ask leave to do so in support of my first paper. The learned writers, Messrs. Abbott and Stephens, conclude, from the tenor of my paper, that I had not made myself acquainted with what had been done in attempting to elucidate the mystery of smut. I desire to say that for the last 14 years I have obtained and read all the papers I could find upon the subject, but scarcely two of the writers agree in the most important points, and the whole of the writings that I have read deal more with effect than cause, that is, with the diseased plant. We all know that when we see either cattle or horses infested with vermin that the animal is weakly and poor ; but we do not believe that the vermin cause the poverty, but the reason we know is that poverty from disease or starvation breeds vermin, and this is my experience with plants and trees ; and I am strongly of opinion that it is the same with our grain plant, the plant being weakly from defective rooting it is attacked by fungus. My object in asking for space in the Botanical Gardens was not with a desire to carry out scientific examinations, but to demonstrate that sound grains will not produce smut, and that the so-called spores are as harmless as soot dust, that is if practical tests of sixteen years are of any value, and I further concluded that the only way to interest the public and induce other societies to take the matter up, was to carry out the tests in some public place, and if my experience was confirmed that some means might be devised by which the seed grain could be threshed without injury, which would prove an enormous saving of grain, labour, expense, and a more vigorous plant. The tests I enumerated were only a few of the many ; I tried all with the same result. I have now one and a half acres sown this year with wheat collected upon stock that had been shaken out in removing sheaves ; this I have not dressed. I do not fear the result. It is too late to carry out any further tests this year."

"Tea Tree, August 23, 1889. Curator of the Museum, Hobart.—Sir, —In forwarding the exhibit of salt it cannot be classed as one of our manufactures, as it is a natural product of the centre of Tasmania, and it seems to me more of a curiosity, or more properly a source of undeveloped wealth, as nothing has ever been done to ascertain the source of the constant and inexhaustible deposit. These chains of lagoons, or what are known as the salt pans, are situated nearly in the centre of the colony, and are situated on the estates of Lower Park, Balochmyle, Ellenthorpe, and Mona Vale. I am well acquainted with these pans, having known them for nearly 50 years. They extend for a distance of seven miles, running as nearly as, I should say, south-east by north-west, and there are to my knowledge 10 of them, in area from one acre to 100. There may be more beyond my travels, and I think if a line was drawn it would be found that they are not over one mile out of line. To my mind, the most mysterious fact is that on either side of this line there are similar pans containing fresh water. In one case at Ellenthorpe there is one large pan of probably 100 acres, and within 10 chains on either side there is a lagoon of fresh water. The most prolific in salt of these pans is Ballochmyle and Mona Vale, as over 50 years ago I went with my father to these pans for a supply, and in dry seasons large quantities have been taken from those pans, many hundreds of tons ; the surface, about 2in. deep, is scraped up for domestic use, and the soil is used for manure. A very old hand in the colony, John Duffield, who came in the prison ship Dromedary, informed me that this salt was formerly a source of wealth to the aboriginals who owned the surrounding lands, and was often the scene of hot battle and bloodshed. I have heard several theories of the source of supply, but none of which are tenable. The one is that it is brought from higher levels by streams, but most of them are situated upon a level surface and have no inlet. Another is that the land is impregnated with salt, and that the supply is kept up by soakage, but if this was so it would follow that the whole of these pans would be salt, which I have shown is not the case. My idea is that a reef extends throughout the length of these pans. Supposing this to be so, would the salt rise from any great depth? I think not, and if my theory is correct, the reef cannot be far from the surface.

Mr. STEPHENS said Sir Lambert Dobson, who had had a lengthy knowledge of the district, might impart some information.

Sir LAMBERT DOBSON had known the salt pans district for a period of 53 years. They were really small lakelets which contained salt water, and from which, during summer, the evaporation caused the layer of salt to form. In past years this was made a source of revenue by collectors of the salt, which was of excellent quality, and suitable for domestic purposes. Some of the lakelets provided richer deposits of salt than others, but no reliable information, so far as he was aware, was forthcoming respecting the origin of these deposits. Evidently they did not originate from springs, because during summer the lakelets dried up. The soil around was fertile, the native grasses growing well. This suggested that the water became impregnated with salt below the surface.

Mr. JOHNSTON considered the subject one of deep interest, and worthy of consideration at the hands of members of the Society. He thought that Mr. Barwick had given good reasons in favour of the idea that the salt was derived from some underlying rock formation of marine origin—probably of upper palæozoic age—whose members are often highly charged with saline matter.

Mr STEPHENS said it would be interesting to ascertain from the inhabitants of the district if the trade in the salt had been discontinued owing to a decrease in the supply, or market influences. The difference between salt and fresh water lagoons was that the latter always had natural outlets, and even if some of these lagoons having outlets contained a percentage of salt from the solid deposits, the outflow naturally brought about a reduction of this. Many of the sandstone formations in Tasmania were particularly saliferous, and contained large percentages of all the salts, from Epsom salt and alum to chloride of sodium. This especially was noticeable in caves which protected the deposits from being carried away by the rain. It should be remembered that a large portion of this district had been under the sea about the tertiary period, if not in post tertiary times. The possibility of the existence of a solid bed of salt, as suggested by Mr. Johnston, should not be ignored.

Mr. JOHNSTON doubted this.

Mr. STEPHENS said that the district, as far as Antill Ponds, gave evidence in favour of this. Marine fossils were not likely to be found where the land had been rising or in drift.

THE LAST LIVING ABORIGINAL OF TASMANIA.

Mr James Barnard read the following paper compiled by him upon this subject:—It has been generally supposed that the grave has closed over the remains of the last of the aborigines, and that the extinction of the race has been final and complete. This supposition, however, is believed to be erroneous; for there still exists one female descendant of the former "princes of wastes and lords of deserts' in the person of Fanny Cochrane Smith, of Port Cygnet, and the mother of a large family of six sons and five daughters, all of whom are living. Some doubts have been cast in Parliament and elsewhere upon the claim of Fanny (to keep to her pre-nuptial and first Christian name) to be of the pure blood of her ancestors, but after searching the records, and upon her own personal testimony, and from other evidence, there seems to be little reason to doubt the fact. It appears, then, that Fanny was born at Flinders Island in 1834 or 1835, and is now about 55 years of age. Sarah was the name of her mother, and Eugene that of her father, and both were undeniably aboriginals. Sarah first lived with a sealer, and became the mother of four half-caste children; and was subsequently married to Eugene (native name, Nicomanie), one of her own people, and had three children, of whom Fanny is the sole survivor and representative of the race. Lieut. Matthew Curling Friend, R.N., in a paper read before the Tasmanian Society, on March 10, 1847, "On the decrease of the Aborigines of Tasmania," in alluding to the curious theory propounded by Count Strzelecki, that the aboriginal mother of a half-caste can never produce a black child should she subsequently marry one of her own race, controverts this notion of invariable sterility by quoting two instances which came under his notice while visiting the aboriginal establishment at Flinders Island. I give his own words:—"One was the case of a black woman named Sarah, who had formerly four half-caste children by a sealer with whom she lived, and has had since her abode at Flinders Island, where she married a man of her own race, three black children, two of whom are still alive. The other, a black woman named Harriet, who had formerly by a white man with whom she lived two half-caste children, and has had since her marriage with a black man a fine healthy black infant, who is still living." Commenting upon this doctrine of Strzelecki, West observes (Hist. of Tasmania, vol. 2, p. 75.), "A natural law by which the extinction of a race is predicted will not admit of such serious deviations." Some explanation may properly be expected from me for reviving a question which was supposed to be set at rest when Truganini was consigned to the tomb, and declared to be the last woman of her race. I will therefore mention the incident which has given me something of a personal interest in the matter. It is now nearly 40 years ago that I was accustomed occasionally to accompany my friend, the late Dr. Milligan, the Medical Superintendent of the Aborigines, to the settlement at Oyster Cove, where I saw a good deal of the native people, at that time some 30 or 40 in number. Among these I have a distinct recollection of Fanny, who was then apparently about 17 years of age, slender and active, less dusky in colour, but rather more prepossessing in appearance than any of her kind; and certainly at that time I never heard a doubt expressed of her not being a true aboriginal. There was one circumstance in particular which impressed her upon my remembrance, and that was on one occasion we crossed over in a boat from Oyster Cove to Bruni Island, rowed by four of the black men, and Fanny taking the steer-oar, which she handled with marvellous skill and dexterity. My visits to the settlement shortly after ceased, and from that time to the present, until a few weeks ago, when I was greatly surprised to receive a visit from this identical Fanny, who had become transformed into a buxom matron of considerable amplitude. By the courtesy of the Hon. P. O. Fysh, Chief Secretary and Premier, I have been permitted access to the official records bearing upon the subject of this investigation. The first documents brought under my attention were two letters under date June 23 and 26, 1882, embodying a report from the Police Magistrate of Franklin, the late E. A. Walpole, emphatically stating that Fanny "is a half-caste, born of an aboriginal woman, by a white man whose name is unknown, at Flinders Island on or about the year 1835." No authority beyond the expression of his individual opinion is adduced by Mr. Walpole in support of his statement. The next document was a letter by the late Dr. Milligan, Medical Superintendent of Aborigines, under date July 17, 1854, enclosing William Smith's consent to marry Fanny Cochrane, and describing her as an aboriginal girl belonging to the establishment at Oyster Cove. This affords strong evidence in support of the opposite view of the case, as those who knew Dr.

Milligan would remember how precise and accurate he invariably was in any statement of facts. A point of some importance in the contention would arise from Fanny's second name, Cochrane. According to Bonwick, in his "Last of the Tasmanians," p. 282, this was taken from the sealer who lived with Sarah, whose name was Cottrel Cochrane. Were this so, it would have at once have gone far to settle the question of parentage, and show her to be the half-caste supposed. Bonwick is obviously in error in his statement; for I have lately ascertained from the lips of a married lady living in Hobart, a daughter of the late Mr. Robert Clark, catechist at the aborigines establishment, that Cochrane was the maiden name of her mother, and that it was given by her father to Fanny when a child, and residing in his family. Again, Bonwick writes (p. 310): "We read of a sawyer, one Smith, and his black friend, Mrs. Fanny Cochrane Smith, receiving £25 a year for their half-caste child." Instead of "black friend" he might have written "black wife;" for the parties were duly married at Hobart by the Rev. Frederick Miller, Congregational minister, in 1854. As respects the cause assigned for the annuity, this writer was also in error, for the sum of £24 (not £25) was bestowed upon Fanny on the occasion of her marriage, and not for the reason stated. The next document is a letter dated 8th December, 1842, conveying the official approval of the admission into the Queen's Orphan School of the three aboriginal children named in the margin—Fanny, Martha, Jesse. Then follows in the records under same date an application from Mr. Robert Clark, late catechist of the aborigines on Flinders Island, for permission to receive into his family "an aboriginal child named Fanny, upon his engagement to feed, clothe, and educate her as one of his own children."

Next is an extract from an official document dated 8th March, 1847:—"Eugene and his wife, the father and mother of Fanny and Adam, being asked if they were willing that their children should be sent back to Mr. Clark, said they were not. Fanny being asked if she understood the nature of an oath, answered, 'No,' and the doctor explained it. Fanny said she did not wish to return to Mr. Clark."

From a long report to the Government by Dr. Milligan, dated November 29, 1847, I have taken the following extract:—"The fifth girl, Fanny Cochrane, almost a woman, might remain with her half-sister, Mary Ann. Indeed, I can scarcely say how otherwise she could be satisfactorily disposed of." There being no difference of opinion as to Sarah being the mother of both, this testimony, given by Dr. Milligan as to a difference of parentage in the case of the father, at once discriminates her from Mary Ann, and in itself affords a strong presumption in favour of the contention.

The superintendent at Oyster Cove, under date 4th November, 1857, reports to the Colonial Secretary the death of Adam, aged 20 years, the youngest of the aboriginals; and states that during his illness he was waited upon by his mother, sister, and the latter's husband; these being respectively Sarah, Fanny, and William Smith. Up to this point my researches have been eminently satisfactory, and have tended to confirm the theory of Fanny being an aboriginal; but another document has been brought under my notice which, unexplained, certainly discountenances that theory. It is the report of certain proceedings taken before Dr. Jeanneret, the superintendent at Flinders Island, on the occasion of certain allegations made against an officer of the establishment, and in which is a deposition made by Fanny, dated March 25, 1847, commencing with these words,—"I am a half-caste of Van Diemen's Land. My mother is a native. I am about 13 years of age," etc., with her signature attached at the foot. At first sight this admission would appear to be conclusive and unanswerable; but, upon reflection, I am led to believe that there must be a mistake somewhere. In the first place a child of her age, with imperfectly developed intelligence, would scarcely be likely to volunteer that statement, or do more than give a mechanical assent to the question when asked, without, perhaps, at all understanding its import. Again, possibly the clerk writing the deposition may have understood that Fanny was sister to Mary Ann instead of half-sister, and naturally assumed them to be the offspring of the same parents. Besides, it conflicts with all the official correspondence in which she is referred to with Dr. Milligan, the medical superintendent, and Mr. Clark, the catechist, in all of which the term "half-caste" never once appears, and she is invariably designated an aboriginal girl, and distinguished from Mary Ann, her half-sister, and an undisputed half-caste. I may add, also, that Fanny wholly repudiates all knowledge or recollection of the evidence referred to. The paper of Lieut. Friend, which I have quoted, in which he refers to Sarah, the mother of Fanny, in support of his hypothesis, as well as the official statement given of Eugene being her father and Adam being her brother, should remove all doubt as to Fanny being a true aboriginal. While it is not to be denied that differences of opinion exist on the point, I think it must be allowed, from the facts brought forward, that the weight of testimony is in its favour. The characteristics of the complexion and of the hair have been cited as favouring the opinion that Fanny must be deposed from the pedestal claimed for her as a pure aboriginal and placed in the ranks of the half-castes. Mr. Walpole states that "her colour is a very dark brown," but I should rather term it a blackish-brown, and showing the true aboriginal tint. On this point it must be remembered that from her infancy she has been encircled within the pale of civilised life, and shielded from the severities of weather and privations to which otherwise she would have been exposed,—all this, together with her surroundings, must naturally have in some degree tended to exercise a modifying influence. The same as to her hair, which, if less woolly and like a mop, has no doubt been combed and brushed out to some small extent of its original fluffiness to reconcile it to the model of the hair of the white children with whom she was brought up, and which she would naturally strive to imitate. The question at issue may appear, at first sight, to be a mere personal matter, and of comparative unimportance, but it is in reality much more than that, and has acquired a scientific aspect deserving of attention. There is reason to believe that the theory of Strzelecki has influenced many to concurrence in his views, and to disregard or overlook the cogency of facts opposed to it. Lieutenant Friend, as we have seen, disputes the dictum referred to, and has adduced strong evidence in support of his objection. Thus an interesting problem has been presented for solution. All controversy, however, must now be regarded as finally set at rest, since the adoption by Parliament, after due inquiry, of two resolutions passed, respectively, in sessions 1882 and 1884, by the first of which the pension of Fanny Smith was increased from £24 to £50 per annum, and by the second that a grant deed of the 100 acres of land she at that time occupied, and for the 200 acres additional then presented to her, should be issued to Fanny free of cost, both votes being passed on the ground specified of her being the last survivor of the aboriginal race.

Mr. Taylor did not doubt Mr. Barnard had made very searching inquiry before submitting his paper. There was much that was new in the paper, and he hoped if any members possessed any further evidence respecting this much-vexed question, they would not fail to place it before the Society.

NEW DARK FIELD MICROMETER.

In the absence of Mr. A. B. Biggs, the Secretary read a paper contributed by that gentleman on "a new dark field micrometer for double star measurements." The author referred to the fact that some of the grandest achievements of science were due to workers who had had to content themselves with very simple and perhaps roughly constructed apparatus, the outcome of their own ingenuity, called forth by the necessities of the case. The writer claimed the applicability of these remarks to his own case only so far as they related to the necessity of trusting mainly to his own resources in his very limited field of scientific work. The instrument, of which he furnished a description, had been in this way the outcome of his necessity; its special function being the measurement of very minute angular distances, such as those of double stars, giving at the same time the angle of position with reference to the meridian.

PYRAMIDAL NUMBERS.

Mr. JOHNSTON read a paper on a discovery made respecting pyramidal numbers, suggesting that these might have formed the original selections of sub-divisions of time, space, weight, coinage, etc.

Mr. Johnston suggested that as the Egyptian pyramid builders were great geometricians, the peculiar combinations of numbers in models of simple pyramids of odd, even, and mixed numbers would be familiar to them; and that the square pyramid of even numbers with 12 as base and the odd and even square pyramids with a base of twice 7, or 14, might be seized upon by them for typifying astronomical facts, in conjunction with some great fixed standard of measurements. The selection of these types might be supposed reasonable, as the aggregates or squares of cubes in their principal divisions coincide exactly with the known days of year, month, week, etc.; their simple multiples also coincide with the principal dimensions of the Great Pyramid of Egypt, and with the length of the Egyptian cubit; while many of the natural sequences of related layers of cubes such as 4, 12, 20; 28, 56, 112; 44, 220, 440; 12, 24, 36, 144—are very suggestive, as accounting for the origin of many of our more important existing sub-divisions of time, space, weight and money.

Mr. TAYLOR said it would be almost impossible to discuss such a paper. He suggested the advisableness of dividing the work of the Society into different branches. They might form a Philosophical Society to deal with subjects apart from the scientific subjects now dealt with by the Society. Many subjects would, he thought, be dealt with under such an arrangement.

Mr. MORTON said the Society was always ready to discuss papers on any subject. They were too small to have these sub-sections. This had been done in the past, and lasted but a very short time. The Council had considered the matter some three years since, and decided that the Society was too small to thus sub-divide themselves. The papers of late years had been most varied, and had always been ably dealt with. He drew attention that a member of the New South Wales Society had congratulated them on the fact that the Royal Society of Tasmania in the thoroughness of its work had only one contemporary society in the colonies that held higher position than them, viz., the Linnæan Society of Sydney.

COMPLIMENTARY.

The PRESIDENT in moving the usual complimentary vote to contributors of papers, said he thought the Society specially indebted to Mr. Barnard for his paper. The records of the Society were for all time, and it would be to these records that reference would be made for authentic information on a matter of this sort. He thought the paper would help much toward the settlement of the question as to the last of the Tasmanian aboriginals, seeing that it adopted the scientific method of taking nothing for granted, but giving data for all his conclusions.

Mr. Mault had acted wisely in getting the only gentleman who differed from his expressed views respecting Flinders detention, to read his paper there respecting—(Laughter)—whilst Mr. Johnston's paper had perfectly staggered him (the President) by its ingenuity.

The proceedings then terminated.

LIBRARY ADDITIONS.

List of additions to the Library of the Royal Society :—

Acta Horti Petropolitani, Tomus X. From the Society.

Annales de la Société Entomologique de Belgique, Brussels, 1889. From the Department.

Annals and Magazines of Natural History, current numbers.

Anales de la Oficina Meteorologica Argentina, Tomo VI, 1888. From the Department.

Archives du Musée Teyler, Serie II, vol. III, Deuxieme Partie. From the Society.

Annual report of the Secretary for Mines of Victoria. On the working of the regulations and inspection of mines and Mining Machinery Act during the year 1888. From the Department.

Blowpipe The, in Chemistry, Mineralogy, and Geology, containing all known methods of anhydrous analysis, many working examples, and instructions for making apparatus, by Lieut.-Colonel W. A. Ross, R.A., F.G.S. Illustrated (bound), London, 1889.

Bolletino dei Musei di Zoologia ed Anatomia Comparata (current parts). From the Society.

Boleteim da Sociedade de Geographia de Lisboa (current numbers). From the Society.

Boletin Mensual (pamphlets). From the Meteorological Department, Mexico.

Bollettino della Societa Geografica Italiana (current numbers). From the Society.

Bulletin de la Sociétié Academique Indo-Chinoise de France. From the Department.

Bulletin de la Société D'Ethnographie, Nos. 1 to 6, Paris, 1887. From the Society.

Bulletin de la Sociétié Imperiale des Naturalistes de Moscow (current numbers). From the Society.

Bulletin of the Museum of Comparative Zoology at Harvard College, Vol. XVII. The Coral Reefs of the Hawaiian Islands (plates), by Alexander Agassiz. From the author.

Catalogue de la Bibliothèque dressé par C. Ekama. Septieme Livraison. Mathématiques ; Chimie et Physique, Astronomie ; Météorologie. Huitième Livraison, Archéologie. Antiquites, etc. Arts et Metiers, Miscellanus, Supplément et Additions ; Table Alphabetique, Harlem, 1887-8. From the Society.

Descriptive Catalogue of the Sponges in the Australian Museum, Sydney, 1888. From the Trustees.

Eruption of Krakatoa, The, and Subsequent Phenomena, (bound) 1888

Franklin, the Lightning Conductor (a lecture), by C. Tomlinson, F.R.S. From the Author.

Geological Magazine. Current numbers.

History of the Birds of New Zealand, second edition, vols. 1, 2. London, 1888. Illustrated (bound).

History of the Yorkshire Geological and Polytechnic Society, 1837-1887. With biographical notices of some of its members, by James W. Davis (bound). From the Society.

Imperial Federation, current Nos. From the Editor.

Iconography of Australian species of Acacia and cognate genera. By Baron Mueller. Decade 13. From the Government.

Insect World. Being a popular account of the orders of insects, together with a description of the habits and economy of some of the most interesting species. By Louis Figuier (Illustrated) bound.

Journals and Proceedings of the Parliament of Tasmania, Vol. XI, 1888-9, bound. From the Government.

Journal and Proceedings of the Royal Society of New South Wales, Vol. XXII., Part II., 1888. From the Society.

Journal of Morphology, edited by C. O. Whitman and E. P. Allis. Vol. II., No. 3 plates. From the authors.

Journal of the Royal Microscopical Society of England. Current numbers. From the Society.

Leeds Philosophical and Literary Society. Report for 1888-9. From the Society.

Lord Howe Island; its Zoology, Geology, and Physical Character, 1889. From the Trustees Sydney Museum.

Metallurgy of gold: A practical treatise on the metallurgical treatment of gold-bearing ores, including the process of concentration and chlorination, and the assaying, melting and refining of gold. By M. Eissler. Illustrated (bound). London, 1889.

Metallurgy of silver: A practical treatise on the amalgamation, roasting, lixibiation of silver ores, including the assaying, melting, and refining of silver bullion. By M. Eissler. Illustrated (bound). London, 1889.

Meteorological Department, New Zealand, 1885. From the Department.

Meteorological papers. From the Department, Mexico.

Meteorological Monthly Weather Review, Canada, current numbers. From the Department.

Minerals of New South Wales, etc., by A. Liversidge, M.A., F.R.S., with map, bound. From the Author.

Mineral Statistics of Victoria for 1887. From the Department.

Monthly Notices of the Royal Astronomical Society, current parts. From the Society.

Narrative of a journey to the shores of the Polar Seas, in the years 1819, '20, '21, and '22, by John Franklin, captain R.N., F.R.S., with an appendix on various subjects relating to Science and Natural History. Illustrated by numerous plates and maps. London 1823. Narrative of a second expedition to the shores of the Polar Sea, in the years 1825, '26, and '27, by Captain John Franklin, R.N., F.R.S., including an account of the progress of a detachment to the Eastward by John Richardson, M.D., F.R.S., F.L.S. Plate and maps. London, 1828 (bound); 2 vols. From Lieutenant-General Sir Henry Lefroy.

Nature. Current numbers.

New Hepatic A. By Dr. B. Carrington and W. H. Pearson. From the authors.

Observatorio Nacional Argentine. Vol. x. Cordoba. From the department.

Ocean World: Being a description of the sea and home of its inhabitants, from the French by Louis Figuier, Illustrated (bound).

Papers from the Registrar-General's office, New Zealand.

Phormium Tenax as a Fibrous plant (bound). By Sir James Hector, R.C.M.G. From the author

Proceedings of the Linnean Society of New South Wales. Second ser. Vol. IV., Pt. 1, 1889. From the Society.

Proceedings of the Royal Society of Queensland, 1889. Vol. VI., Pt. 2. From the Society.

Proceedings of the Yorkshire Geological and Polytechnic Society, Vol. XI., Pt. 1, 1889. From the Society.

Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia, 1888-9, Vol. IV. From the Society.

Proceedings and Transactions of the Royal Society of Canada. Vols. III., 1885; IV., 1886; V., 1887; (bound). From the Society.

Psyche, a Journal of Entomology, Mass., U.S. (Current numbers.) From the Society.

Report of the Trustees of the Australian Museum for 1888. From the Trustees.

Report of the Public Library, Museum, and Art Gallery of South Australia for 1887-8. From the Trustees.

Report of the Zoological and Acclimatisation Society of Victoria for the year 1888. From the Society.

Report of the Surgeon-General of the Army to the Secretary of War for the fiscal year ending June, 1888. From the Department.

Report of the Auckland Institute and Museum for 1888-9. From the Trustees.

Report of the Mining Registrars of the Goldfields of Victoria for the quarter ended 31st March, 1889. From the Department.

Report, Twenty-third Annual, on the Colonial Museum and Laboratory, etc., New Zealand. From the Trustees.

Reports of Geological Explorations during 1887-8, with maps and sections, New Zealand. From the Department.

Revista do Observatorio, Rio de Janeiro, 1889. From the Department.

Records of the Geological Survey of India (current numbers). From the Society.

Results of Astronomical Observations made at the Melbourne Observatory in the years 1881 to 4 (bound). From the Department.

Scottish Geographical Magazine (current parts). From the Society.

Scientific Proceedings of the Royal Dublin Society (current numbers). From the Society.

Scientific Transactions of the Royal Dublin Society. II. A monograph of the marine and freshwater ostracoda of the North Atlantic and of North-Western Europe. Section I. Podocopa. By G. S. Brady, M.A., and Rev. A. M. Norman, M.A. Plates. III. Observations of the Planet Jupiter made with the reflector of three feet aperture at Birr Observatory, Parsonstown, by Otto Boeddicker, Ph.D. Plates. IV. A new determination of the latitude of Dunsink Observatory, by Arthur A. Rambaut. V. A revision of the British Actiniæ, Part I, Alfred C. Haddon, M.A., etc. Plates. From the Society.

Studies from the Newport Marine Laboratory. Communicated by Alexander Agassiz. XVI. The Development of Osseus Fishes. II. The pre-embryonic stages of development. Pt. Ia. The history of the egg from fertilisation to cleavage. By A. Agassiz and C. O. Whitman. With 12 plates. From A. Agassiz.

Statistics of the colony of New Zealand for 1887. From the Department.

Transactions of the Royal Society of Victoria, Vol. I., part I. The Anatomy of Megascolides Australis. The giant earth worm of Gippsland, by W. Baldwin Spencer. From the Author.

Transactions and Proceedings of the New Zealand Institute, 1888. Vol. XXI. From the Department.

Transactions and Proceedings and Report of the Royal Society of South Australia. Vol. XI., for 1887-8. From the Society.

Text Book of Geology, by Archibald Geikie, London 1882 (bound).

Verhandlungen des naturhistorischen vereines (current Nos.) From the Society.

Verhandlungen de Gesellschaft Für Erdkunde zu Berlin (current Nos.) From the Society.

Victorian Naturalist (current Nos.) From the Society.

Victorian Year Book for 1887-8, Vol. III. From the Department.

OCTOBER, 1889.

The monthly meeting was held on Monday evening, October 15. There was a large attendance of Fellows and several lady visitors were present, including Lady Hamilton. His Excellency (Sir Robt. G. C. Hamilton, K.C.B.), President of the Society presided.

NEW MEMBER.

Mr. Alex. Montgomery, M.A., Government Geologist and Inspector of Mines, was elected a Fellow of the Society.

THE PRESIDENT AND "LYNX."

The **President** said : My attention has been drawn to a paragraph in last week's *Tasmanian Mail* in a column headed, "Echoes" by "Lynx," in which an amusing account is given of an error I am supposed to have fallen into in describing some of the young salmon hatched from the ova brought over by Sir Thomas Brady, as "markedly bull headed." I am supposed to have seen them, as I think the writer sometimes sees things, through a distorted medium. (Laughter.) Now, I am sorry to spoil so good a story. The fish I examined were not looked at through a glass, and there is now here, in the Museum, one of these fish which is "markedly bull headed." I do not have the acquainntace of "Lynx," or I may have that pleasure without knowing it, but if he will call here, or if he is here now, he can take the fish out of the bottle and look at it for himself, and I am sure he will agree with my description of it. But a more interesting point arises as to these fish. It almost seems as if some of the characteristics of these young salmon vary with their size, or the season of the year, or whereas a short time ago certainly half the fish had spots on their dorsal fin and a coloured tip to their adipose fin, the Curator the other day could only find one possessing these characteristics, and that a small one. This is a matter which might also be brought under Sir Thomas Brady's notice when the specimens are sent to him. (Applause.)

Mr. R. M. **Johnston** felt glad that His Excellency had noted these peculiar characteristics, because Tasmania was the first to demonstrate to the world the possibility of safely transporting fish over a great distance. They had many things to consider in connection with the acclimatisation of the fish, and it was a matter of great importance that the results of their observations should be communicated to the experts in the Old Country.

EARLY SETTLEMENT OF TASMANIA.

Mr. J. B. **Walker** read a very interesting paper entitled "The settlement under Collins in 1803-4 : The failure at Port Phillip." The paper was a continuation of the very complete and graphically historic account of the foundation of the colony which he has compiled from official papers, reports, etc., obtained at the instance of the Tasmanian Government, by Mr. James Bonwick, in London. Former papers prepared by Mr. Walker dealt with the early visits of French and English navigators to the colony, and in this one he gave an account of the voyage of Lieut. Collins when under instructions to found a colony at Port Phillip, and the failure to do so. The paper was attentively listened to, and upon concluding the writer was heartily applauded.

Mr. A. J. **Taylor** favoured Mr. Walker's suggestion because he had no doubt these documents would be more highly prized. He was in hopes that before long they would have an opportunity of securing for the Public Library a large number of works relating to the early history of the colony.

THE AUSTRALIAN CURLEW.

Mr. MORTON, acting for Colonel Legge, read a note embodying a comparison of the Australian Curlew with its near Asiatic ally, and its more distantly related representative in Europe and Western Asia. The curlews of the old world, like other members of the Wader family (*Charadriidæ*), resemble one another in plumage. Unlike the American curlews, which have a distinguishing characteristic in the buff tinting of the under wing and axiliaries, the old world species differ chiefly in the character of the markings of the breast. A marked characteristic, however, of the Australian bird is its length of bill. As regards our Curlew (N. Cyanopus) on arriving in Tasmania in September, some specimens have the buff tinge of the breeding season still remaining on the breast and flanks, and accompanying this is a rufescent hue on the longer upper tail coverts and central tail feathers. Although the Australian Curlew is a migratory species, breeding in northern climates in summer and "wintering" here in our summer, many seem to remain throughout the year with us. It migrates north as far as Hakodadi, in Japan, and east as far as New Zealand. The Eastern curlew ranges across the continent to China, southward to China, and down the East coast of South Africa. The range of the European Curlew is throughout Europe, taking in the Orkney, Faroe, and Shetland Isles, and extends down the coast of Africa to Damara Land. It would therefore appear to take in the west coast, while the Asiatic, or "Eastern" Curlew monopolises the east coast and the extreme south in its wanderings.

ASTRONOMICAL PAPERS.

Mr. A. B. Biggs, of Launceston, forwarded two papers, which were taken as read. One was entitled "Observations of comet of July and August, 1889, taken at Launceston, Tasmania," and "Recent measurements of α Centauri."

SILVER ORE.

Mr. A. J. TAYLOR exhibited a specimen of the silver ore struck at the 100ft. level in the Silver Queen mine at Mount Zeehan.

PALÆOZOIC FOSSILS.

Mr. JOHNSTON tabled a paper, which he said formed a sequel to a paper he had read some time ago dealing with additions to the list of upper palæozoic fossils. The paper, at the author's request, was taken as read.

FUTURE SUBJECTS.

Mr. JOHNSTON reminded those present that some time ago the President had suggested that the Society should deal with a wider range of subjects. He had brought down a paper, "Root Matters in Social and Economic Problems," and if thought desirable it might be printed and circulated amongst the Fellows in time for discussion at the next meeting.

The PRESIDENT stated that the Council would be pleased to consider the suggestion.

VOTES OF THANKS.

The PRESIDENT, in moving a vote of thanks to the authors of the papers, referred in flattering terms to the one read by Mr. Walker. It was well that they should now perfect the early history of the colony for they were nearer to the old times than those who had to follow, and it was a work which the Society should take in hand, as it was to a Society of this sort that anyone would come for accurate records of their early history.

The vote was accorded by acclamation, and the meeting terminated.

NOVEMBER, 1889.

The last meeting of the Royal Society for the present session was held at the Tasmanian Museum on Monday evening, November 18, 1889. There was a large attendance of Fellows and several ladies, and His Excellency the Governor (President) presided.

ELECTION OF FELLOWS.

Bishop Montgomery and Mr. J. H. Innes were elected Fellows, and Drs. Schewiakoff and Lanterbach and Mr. F. D. Power were elected corresponding members. The PRESIDENT, in declaring the results of the ballot, said he was sure they would all sympathise deeply with the Bishop in the trouble with which his family were afflicted, and had it not been for that he had no doubt they would have had him present with them that evening.

SOCIAL AND ECONOMIC PROBLEMS.

Mr. R. M. JOHNSTON, F.L.S., read copious extracts from a very able paper, which he had prepared, entitled "Root Matters in Social and Economic Problems." When he had concluded, the PRESIDENT said such a paper required the most careful study and thought before anyone should speak upon it, but he hoped next session they would have certain points in the paper discussed, which he was sure would raise issues of the greatest interest. The reading of the paper was received with loud applause.

THE FOUNDING OF HOBART.

Mr. J. B. WALKER read a paper entitled "The Founding of Hobart." This was a further contribution to the series of articles by that gentleman upon the early history of the colony, based upon original official documents preserved in the English State Record Office, and recently copied by Mr. Bonwick for the Tasmanian Government. A former paper had given the history of Lieutenant-Governor Collins' expedition in 1803 down to his abandonment of Port Phillip as unsuited for settlement. The present paper took up the story from the sailing of the first detachment from Port Phillip in the ships Ocean and Lady Nelson for the Derwent. The ships arrived on February 15, 1804, and Collins, being dissatisfied with Risdon, chose Sullivan's Cove as a better locality, and on February 20 pitched his tents on the site of Hobart. The landing place was Hunter's Island, now part of the Old Wharf, but then an island connected by a sandbank with the mouth of the creek, which at that time fell into the river at the Fishermen's Dock. A dense scrub bordered the creek, along the banks of which grew gum-trees of the largest size. The camp was pitched on the slope between the creek and the cove, and extended up towards the present site of the Cathedral. The description was illustrated by a very beautifully executed plan by Mr. A. Mault, showing the alterations made by subsequent filling in of the harbour. Governor Collins' despatches and general orders, and the diary of Mr. Knopwood, the chaplain, supplied the materials for an interesting account of the progress of settlement during the first months, the clearing of the ground now forming the centre of the city, the building of the first Government House—a wooden cottage on the site of the Town Hall—the location of the settlers at New Town Bay, the formation of a Government farm at Cornelian Bay, and the building of huts of "wattle and dab" for the prisoners. The prices of labour were fixed at 3s. 6d. per day for mechanics, and 2s. 6d. for labourers. Workmen were paid in provisions, too often in rum, and the only currency was small promissory notes issued by the Government. Kangaroo, emu, pigeons, quail, and black swans were plentiful, and during the winter months black whales abounded in the river, as many as fifty being seen at a time. Explorations were made up the Derwent as far as Macquarie Plains, and the Huon was visited. The new settlement received the name of "Hobart Town" after the removal of the Risdon colony, but for years it was generally known as "The Camp." The second detachment from Port Phillip did not arrive until the 25th June, the Ocean being five weeks on the passage. A census taken at the end of July gave the total population at 433.

LIST OF ADDITIONS TO THE LIBRARY.

List of additions to the Library of the Royal Society, November.

Abhandlungen der Mathematisch Physikalischen classe, der Königlich Bayerischen, Akademie der Wissienschaften. From the Society.

American Museum of Natural History. Annual report of the Trustees, etc., for the years 1887-8-9. From the Trustees.

Annual report of the Canadian Institute. Session 1887-8. From the Society.

Bulletin of the United States Fish Commission for 1886 (bound). From the Commission.

Bulletin of the United States Geological Survey. No. 40. Changes in river courses in Washington Territory due to Glaciation, by B. Willis. 41. On the fossil faunas of the upper Devonian, the Genesee section, N.Y., by H. S. Williams. 42. Report of work done in the division of chemistry and physics mainly during the fiscal year 1885-6, by F. W. Clarke. 43. On the Territory and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama rivers, by E. A. Smith and L. C. Johnson. 44. Bibliography of North American Geology for 1886, by N. H. Darlon. 45. Present condition of knowledge of the geology of Texas, by R. T. Hill. 46. The nature and origin of deposits of Phosphate of lime, by R. A. F. Penrose, junr. 47. Analyses of waters of the Yellowstone, National Park, with an account of the analyses employed, by F. A. Gooch, and J. E. Whitfield. From the Department.

Bulletin of the American Museum of Natural History, Central Park, New York, Vol. II., No. 2, March, 1889. From the Society.

Bulletin of the Essex Institute, Vol. 19, 1387, Nos. 1 to 12. From the Institute.

Bulletin de la Societé de Geographie, Redigé avee, la concours de la section de publication, par le secretaires de la commission Centrale Trimestre 1 to 3, Tome IV., 1888. From the Society.

California State Bureau Mining. Eight annual reports of the State Mineralogist for the year ending October 1, 1888. From the Department.

Department of the Interior.—U.S. Geological Survey, J. W. Powell, director. Mineral resources of the U.S. calendar year, 1888, by D. T. Day, Chief of Division of Mining Statistics (bound). From the Department.

General Index to the first twenty volumes of the Journal (Botany), and the botanical portion of the proceedings, November, 1838, to June, 1888, of the Linnæan Society of London (bound). From the Society.

Geological and Natural History Survey of Canada, annual report (U.S.), Vol. II., 1886, reports and maps of investigations and surveys. From the Department.

Geological and Natural History Survey of Minnesota. Sixteenth annual report for the year 1887. Two plates and 80 other illustrations. From the Department.

Historical Collections of the Essex Institute, Vol. XXIV., January to December, 1887, Nos. 1, 2, 3. From the Institute.

Journal of the Royal Statistical Society, of London, General Index, pt. 4, Vols. XXXVI. to L, 1873-87, Vol. LI., pts. III. IV., September-December, 1888, Vol. LII., pts. I-II., March and June, 1889. From the Society.

Journal of the Linnæan Society of England (Botany), Nos. 156 to 1,773 (Zoology), Nos. 19, 20, 21, 32, Vol. XX., Nos. 129, 20, 21, Vol. XXI., No. 132. From the Society.

Journal of the Royal Asiatic Society of Great Britain and Ireland (new series), Vol. XX., pts. 3 and 4, July and October, 1888. From the Society.

Journal of the Royal Historical and Archæological Association of Ireland, Vol. VIII., fourth series, Nos. 76, 77, 1888-9. From the Society.

Journal of the Cincinnati Society of Natural History, Vol. XI., No. 4. From the Society.

Journal of the Trenton Natural History Society, No. 3, January, 1888. From the Society.

List of the Linnæan Society of London, session 1888-9. From the Society.

List of Geological Society of London, November 1, 1888. From the Society.

Meteorological observations made at Hobart, and other places in Tasmania during the year 1888, by Captain Short, R.N., Meteorological Observer. From the Department.

Memoirs of the National Academy of Sciences Vol. IV., part 1. First memoirs. The Cave fauna of North America, with remarks on the anatomy of the brain, and origin of the blind species by A. S. Packard. From the Society.

Proceedings of the Royal Colonial Institute, Vol. XX., 1888-9 (bound). From the Institute.

Proceedings of the Scientific meetings of the Geological Society of London, for the year 1888, parts 2, 3, 4; 1869, part 1. From the Society.

Proceedings of the Royal Geographical Society, and monthly record of Geography, Vol. X, Nos. 9 to 12, 1888; Nos. 1 to 8, 1889. London. From the Society.

Proceedings of the Royal Institution of Great Britain, Vol XII., part II., No. 82; list of members, etc. From the Institute.

Proceedings of the Boston Society of Natural history. Vol. XXIII. Pt. III. February, 1886, December, 1887. Pt. IV., December, 1887, May, 1888. From the Society.

Proceedings of the Academy of Natural Sciences of Philadelphia. Pt. II., March and September, 1888. Pt. III., October and December, 1888. From the Society.

Proceedings of the American Philosophical Society, held at Philadelphia, for promoting useful knowledge. Vol XXX., No. 128, XXXI., No. 129. From the Society.

Proceedings of the American Academy of Sciences, U.S. Vol. XV., whole series. Vol. XX II., pt. 1, from May, 1887, to May, 1888, selected from the records. From the Society.

Proceedings of the Canadian Institute, Toronto, April, 1880, third series, Vol. VI., Fax., No. 2. From the Society.

Quarterly Journals of the Geological Society, Vol. XLIV., pt. 3, Nos. 175-6. Vol. XLV., pts. 1, 2, 3, Nos. 177-8-9, August and November, 1888; February, May, and August, 1889. From the Society.

Report of the Board of Governors of Public Library, Museum, and Art Gallery of South Australia, with the report of the Library Committee for 1888-9. From the Trustees.

Report upon Internation Exchanges under the direction of the Smithsonian Institution for the year ending June 30, 1888. By J. H. Kidder. From the Department.

Report of the Superintendent of the United States Naval Observatory for the year ending June 30, 1888. From the Department.

Report upon Natural History collections made in Alaska, between the years 1877 and 1881 by E. W. Wilson, edited by H. W. Henshaw. No. III. Arctic series of publications issued in connection with the signal service U.S. Army (two plates) (bound). From the Department.

Report of the committee appointed January 6, 1888, by the American Philosophical Society to assist the Commission on amended Orthography, created by virtue of a resolution of the Legislature of Pennsylvania. From the Society.

Revista do Observatoria Rio de Janeiro. From the Department.

Rude Stone Monuments of Ireland (Co. Sligo and the Island of Achill), by W. C. Wood-Martin. From the Royal Historical and Archæological Society of Ireland.

Scottish Geographical Magazine, Vol. V., No. 10, October, 1889. From the Society.

Sitzungsberichte, der Mathematisch—physikalischen classe der K. B. Akademic der Wissenschaften zu München, 1886, Heft 1, II. From the Society.

Smithsonian Miscellaneous Collections, Vol. XXXII. The Constant of Nature, a table of specific gravity for solids and liquids, by F. W. Clarke. Vol. XXXIII., Bulletin of the Philosophical Society of Washington, Vol. VI. From the Institution.

Societe de Geographie, Compte Rendu, des Seances de la Commission Centrale Paraissant deux fois par mois, Nos. 1 to 17 1887. From the Society.

Table Generale des Annales de la Société, Entomologique de Belgique, Vol. XXX., et catalogue des ouvrages Periodique de la Bibliotheque, 26th December, 1887. From the Society.

Transactions and Proceedings of the Royal Geographical Society of Australasia (Victorian branch), Part I, Vol. VII. From the Society.

Transactions of the Institution of Engineers and Shipbuilders in Scotland, Vol. XXXI., 31st session, 1887-8 (bound). From the Society.

Transactions of the Seismological Society of Japan, Vol. XIII., part 1. From the Society.

United States Commission of Fish and Fisheries. Part XIII. Report of the Commission for 1885. A. Inquiry into the decrease of food fishes. B. The propagation of food fishes in the waters of the United States (bound). Illustrated. From the Commission.

United States Geological Survey. Clarence King, Director. Geology and Mining Industry of Leadville, Colorado, with atlas. By S. F. Emmons (bound). From the Department.

Victorian Naturalist, Vol. VI., No. 7. ninth annual report, 1888-9. From the Society.

Visitor's Guide to Salem, Mass. From the Editor.

Astronomical and Meteorological Workers in New South Wales, 1728 to 1860, by H. C. Russell, B.A. From the author.

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THE "IRON BLOW" AT THE LINDA GOLDFIELD.

By G. Thureau, F.G.S.

In the recently issued printed Papers and Transactions of the Royal Society of Tasmania, on page 216, are published some notes by Mr. R. M. Johnston, F.L.S., an esteemed member of the Society, on the "Iron Blow" at the Linda Goldfield, his conclusions having been based upon the examination of some rocks and specimens from that locality received from Mr. Crotty and Mr. Belstead, the Secretary for Mines.

It is upon that remarkable gold-deposit that I desire to offer a few remarks, at the same time embracing the opportunity of supplementing and elaborating my report, No. 146 of 1886, presented to Parliament.

In the following remarks, I shall exclusively confine myself to the question of the probable origin of this unique gold formation in furtherance of my theory of its being due to "volcanic agency," and not, as Mr. Johnston contends, to local decomposition, especially so far as the dark coloured and pulverulent masses are concerned. I may likewise observe that in my report to the Government such questions as these concerning and referring solely to the more scientific aspect, must of necessity be very brief, because the larger questions as to the present or ultimate value of any mineral or metalliferous discovery, are of more immediate practical value as affecting directly the progress of the community at large.

In the first place, it appears that the Secretary for Mines obtained the specimens in question from Mr. Crotty, the discoverer of that "Iron Blow." Subsequently, Mr. Johnston, aided by Mr. Ward, the Government Analyst, concluded that the soft purply black and so highly auriferous mineral was the result of decomposition of some of that immense bed or vein of solid pyrites (iron) filling the greater width of the fissure on its "hanging wall," or about 225 feet out of a total width of 280 feet between walls of that chasm.

Dismissing all speculations as to whether it has been prudent to base any reliably practical opinion, such as to the question of origin of that valuable deposit, upon the examination of "specimens" only, even though, such was to some degree supported by chemical analyses, it further appears from the late Mr. C. P. Sprent's report that, but a very cursory examination of that deposit, *in sitû*, had been made during that gentleman's and associates' tour from the Ouse to the West Coast. Thus, on the whole, a settled and reliable opinion as to the causes governing the past geological history of the "Iron Blow," accounted for by Mr. Johnston as a process of decomposition of materials at hand, in opposition to the theory of volcanic agencies which I have advanced in my report, deserves to be treated in detail, as involving important issues.

Decomposition is, I believe, a chemical process by which the destruction of one or more substances leads to the substitution and depositing of quite different matters, thereby bringing about the rearrangement of the former original substances in quite different forms.

In this case it has been attempted to be proved that those massive beds of pyrites on their decomposition from local causes, were replaced by that highly interesting pulverulent mass reported so rich in gold. Now, I have before me two letters from the Government Analyst, viz.: one dated November, 1824, and the other October, 1885, in which the results of the analysis of "solid pyrites" from that "Iron Blow" are given thus:—In the first letter Mr. Ward states: "I have carefully tested the minerals received . . . . have not been able to detect the presence of tin or any other metal of commercial value;" in the second he says: "In none of the samples forwarded for assay have I been able to find more than *traces* of gold." To these may be added those examples cited in Mr. Johnston's paper, viz.: No. 9, "A sample of Iron Pyrites in which gold is not mentioned as being present, and in No. 7 the sample only shows "fine specks of gold just visible to the eye," but this is not from pyrites, but from the soft purply pulverulent mass, which is about 56 feet wide.

On page 219, the author states: "Whether we suppose that the 'Iron Blow' is due to hydrothermal agency or not, there is nothing in the composition of the iron pyrites or the dark purplish rock which necessitates their having been originally formed in the way of *volcanic mud.*" It is more probable that the four principal elements, iron, barytes, sulphur and gold, were originally precipitated from solution."

Leaving out the references made in the paper in question as to the production of gold elsewhere as foreign to the subject under discussion, and which, however, are not altogether accurate, I beg to direct your attention to the facts upon which I join issue with Mr. Johnston's theory of origination.

The analyses of Mr. Ward, cited by Mr. Johnston and myself, conclusively prove the almost total absence of gold in the pyrites, veins, or beds, which may be described as very dense and excessively solid, and which undoubtedly have resisted both decomposition and dissolution for ages; how is it possible then, I may ask, that these almost *non-auriferous* iron bi-sulphides produced on their supposed (inert) decomposition that peculiar purple mineral, assaying, as reported, considerably above 170ozs. of gold per ton? Again, those so very solid pyrites contain no barytes, which latter minerals I first discovered as the necessary adjunct to the gold. "*Ex nihil aut nihilo fit.*"

It may also be fairly questioned how it is that these veins or beds of pyrites, so dense in character, must have undoubtedly withstood atmospheric influences for immeasurable periods, on decomposition (?) filled, with new substances resulting from that process, over 50 feet in width by over a mile and a half in length, and to unknown depth of an open fissure with a "*solution*" only. Such a fissure or chasm would have collapsed at the sides long before the decomposition process had even been initiated, as the adjacent and superincumbent rocks could not have withstood the lateral and vertical pressure their own great gravity would produce, had not the walls of that fissure been kept apart by some *heavy* filling material of a homogenous kind, exerting in itself a sufficiently powerful resistance to the overhanging walls of this fissure.

Supposing, however, decomposition was the cause and effect of this rich aggregation of minerals and metals, or, in the authors own words: "That it (the Iron Blow) is the result of oxidation of pyrites similar to that now so largely associated with it; the hydrated oxide first formed, being subsequently metamorphosed sufficiently to get rid of its *combined vapour* and produce the slight change in the form of *disseminated particles of barytes*, as revealed by the microscope; or, this process may have occurred during the process of oxidation," etc., etc.

It will therefore be necessary to bear in mind that, as proved from analysis, we have, firstly, a nearly non-auriferous bi-sulphide of iron (pyrites) to deal with, containing *no* baryta to speak of; and secondly, that water is assumed to have produced the rich pulverulent gold rock by means of the decomposition of the former, and contemporaneously or subsequently by means of infiltration filled the fissure, and that *small* (?) disseminated particles of baryta appeared either before (whence?) or during the process of oxidation.

Now, it is a fact that baryta is the "*matrix*" of that purple rock, exceeding "thirty (30%) per cent. of the whole of the vein-matter, being disguised by coatings and linings" of specular iron, and exhibiting gold in fine crystalline and filagree forms; that auriferous rock likewise exhibits a distinctly recognisable vesicular structure, the cells and cavities being now, however, filled by means of similar rock of a denser kind and of a darker colour, as, in all probability, the result of these ore-deposits having become saturated with steam or hot-vapours, and by means of segregation and expansion of these high-pressure volcanic emanations, the cavities or cells were firstly formed and subsequently filled, thus explaining the so-called "*schistose*" appearance, which, from all appearances was principally due to the gradual cooling of a seething mass of volcanic mud or ash which was ejected in combination of several kinds of metallic vapours, such, as for instance, specular iron, which not only forms a conspicuous constituent of that volcanic material, but also occurs quite frequently in the wall-rocks of that immense fissure. In my opinion everything in connection points to a more drastic process of origination than simple and quiescent decomposition only.

That there is strong evidence of the former ebullition and belching forth of metalliferous and mineral vapours at high temperatures within certain ejective points of discharge with the volcanic muds and ashes, is clearly demonstrated by the occurrence of elongated or spherical nodules in these muds and ashes, which nodules on examination are found to contain, within hard crusts of "Limonite"—sesqui-oxide of iron—nuclei of pure iron pyrites, thus pointing the way how the decomposition of pyrites under precisely similar circumstances has actually occurred, and caused the formation of a secondary and hydrated iron ore, and not of *purple rock*, though in very close contiguity to the massive pyrites vein and beds referred to. Those nodules, it is submitted, present, neither more nor less, former gaseous bubbles surcharged with vaporous sulphuretted solutions of iron, becoming rigid when nearer the cooler atmosphere, and which from compression by the surrounding muds, etc., assumed their present characteristically elongated forms.

When it is borne in mind that geologists have concluded that "the nature of vapours evolved depends on the temperature or degree of activity of the volcanic orifices; chlorine and fluorine emanation indicating the most energetic phase of eruptivity, sulphurous gases, a diminishing condition and carbonic acid (with hydro-carbons) the dying out of that activity, and that sublimed by volcanic heat or chemical reactions, causing the decomposition of metals and minerals from condensing vapours along crevices and surfaces wherein they reach the outer air and are cooled; and further that, besides sulphur there are chlorides, and in a lesser degree, iron, copper, and lead; also free sulphuric acid, sal amonia, specular iron, oxides of copper, boracic acid, alum, sulphate of lime, baryta and others, are formed whilst at very high temperatures, and in connection with simultaneously engendered electric currents" it becomes clear to the close and careful observer of these unique gold deposits, *in sitû*, that dynamical geology can alone account for these, strictly speaking, volcanic products.

Having myself had opportunities for examining active "*mud volcanoes*" in 1877, near Carson City, State of Nevada, U.S.A., these "Steamboat Springs" were most interesting, and I can therefore speak with some authority upon the subject. There, as is held by American geologists, these volcanic "vents" occur on the line of continuation of the famous Comstock Lode (silver-gold), and each spring or geyser is indicated at the surface to the visitor, at a distance by a thin column of white steam. When more closely approached, it is found that the discharges of heated mud and vapours are intermittent, and that previous to each of such discharge a greyish semi-liquid mass rises slowly within the mouth of the "fumaroles" below, and on reaching the top of the respective orifices, the carbonic, sulphuretted and other gases encompassed beneath, cause, through pressure, a dome-like expansion of the "volcanic mud," which, however, with increasing subterranean pressure eventually bursts, and allows the "mud" again to subside. Each discharge, it is noted, however, leaves a thin deposit or lamina in the "cups" at the surface, which, after hardening, was found on analysis to be chiefly charged with silica (quartz), and to also contain a sensible percentage of gold and silver. This process is even now in active progress, and as it assimilates a great deal to what can be seen in its "*dead state*" at our "Iron Blow" —if baryta is substituted for silica as matrix in the latter case —the question of origin as to both metalliferous deposits is not only, in my opinion, very suggestive, but forms the only possibly true solution of the case.

By way of further analogy, I would likewise draw attention to the fact of Senor Santos having found "Lead" in the "volcanic ash" from the eruption of Cotopaxi, of August 23rd, 1878, and in a paper read before the Royal Society of England, on January 6th, 1887, Mr. J. W. Mallet, M.D. and F.R.S., etc., reports upon the "Occurrence of *Silver* in Volcanic Ash, from the Eruption of Cotopaxi, Ecuador, of July 22nd and 23rd, 1885."

A condensed extract may prove of interest:—He, Dr. Mallet, received a specimen of volcanic ash from Senor Julian R. Santos, of Ecuador, which was collected at his residence, Bahia de Caraguez, about 102 miles nearly due west from Cotopaxi. This is the highest and most mighty of the active volcanoes of our globe; it erupted on the 22nd of July, and the ash began to fall at Bahia de Caraguez next morning, to a depth of several inches, thus representing an enormous discharge of volcanic and metalliferous as well as mineral matter. The specimens consisted of *a finely divided powder, mobile and soft to the touch, brownish grey in colour.* Under the microscope, the following minerals could be distinguished in the granules and spicules, viz.: quartz, two felspars (one white and one pink), augite, magnetite (strongly magnetic, and scales of deep red *specular iron* oxide. After subjecting this ash to several experimental tests, it was, as a preliminary, found to possess a specific gravity of 2·64 at 18° C, as compared with water at the same temperature. An analysis of the material taken, as a whole, *i,e.*, without any previous mechanical separation of its constituent minerals, and without previous digestion with water or acid, but dried up 100 C., gave no less than sixteen separate ingredients, amongst which were traces of silver. That metal was subsequently obtained by *wet* assay; and it was also afterwards found that it could be obtained from the *ash* by furnace assay—fusion with pure lead carbonate, sodium carbonate and a little cream of tartar, and cupellation of the lead button so obtained or produced, which gave a minute bead of metallic silver; the same reagents were tested in larger quantities, *leaving out the ash*, when negative results followed. It was subsequently ascertained that silver could be extracted from this volcanic ash by boiling it with a solution of ammonia, or of potass, cyanide, or of sodium sulphate."

The discovery of silver in the ash or mud, adds, for the first time, this metal to the list of elementary substances observed in the materials ejected from volcanoes, and the addition derived some special interest from the fact of this ash having come from the greatest volcanic (active) vents of that great "*argentiferous*" zone of the Andes. Small as would be the proportion of silver, it must represent a very large quantity of that metal ejected during the eruption, in view of the vast masses of volcanic ash, etc., distributed over the large area which is indicated by the fall of argentiferous ashes at a distance of 102 miles from the central crater to Bahia de Caraguez.

There cannot be, it is submitted, much difference of opinion that, if silver, lead, iron, manganese, titanium, chlorium, mercury and other less important metals occur in volcanic ash or mud shown by frequent analyses, as derived, *inter alia* from the immensely rich argentiferous formations which that gigantic "vent" cotopaxi protrudes; a similar occurrence here on a smaller scale, within a well-known "*auriferous zone*" is not only feasible, but can be, or is now, demonstrated to be a fact. The only, and to us most valuable difference, is, that the South America ejecta expelled the silver in its ashes, whilst, with our "Iron Blow" the ash or "*mud*" is *still retained* within the "dead" vent or closed fissure, and happily for the colony at large, it is comeatable, and it can be extracted by future systematic mining operations, followed by skilful treatment for the rich gold it is reported same contains.

With regard to the opinion I have had occasion to express in my report to the Government, I may add that the mining operations carried on since still expose rich ores at times, and as Mr. Johnston concludes his Paper by saying: It—the hydrothermal theory—had also been adopted by Mr. Thureau in respect to such mineral formations as the Iron Blow at the Linda, although the latter "seems to be unaware of the fact that the mode of origin of the more common quartz reefs are also frequently ascribed to the hydrothermal agency."

I may be permitted to state that, in the years 1845 to 1848, when a student at the Royal School of Mines, Clausthal, Hannover, Germany, I studied under several eminent professors of geology, and at that time no less than five or more theories—including what is now termed hydrothermal—were known, recognised, and applied practically. Since then I have been, and am still, an ardent student of mining geology in several countries, so that it is not likely that I am ignorant of so important a portion of that science.

When I held, in 1875 to 1877 inclusive, the position as Lecturer at the Bendigo (Victoria) School of Mines, of "Geology as applied to Mining," Mineralogy; also Practical Mining, the Administrative Council of that institution arranged during each winter for a series of public lectures on Popular Science, and at such I elaborated a series of lectures upon the hydrothermal origin of the famous Bendigo Quartz Reefs, without controversy. It appears that at those lectures,—illustrated by models, diagrams, geological specimens, and analysis,—visitors from England, New Zealand, and America attended, and as one result of the interest they must have taken in the subject dealt with, I was subsequently elected, upon unsolicited nominations and recommendations, as a Fellow of the Geological Society of London, which honourable position I still hold and treasure.

ON SOME TIDE OBSERVATIONS AT HOBART DURING FEBRUARY AND MARCH, 1889.

By A. Mault.

Wishing, primarily in connection with the obtaining of necessary information for purposes connected with the drainage of Hobart, and secondarily, to fix the mean sea level for geodetic and engineering matters, to get a series of tidal observations, I spoke to Captain Oldham, of H.M.S. "Egeria," on the subject and he at once arranged to fix the automatic tide gauge of his ship on the New Wharf, and to have observations taken for as long a period as the sojourn at Hobart permitted. I am indebted to him for the accompanying remarks and tables of observations. To enable him to connect his observations with the level of some permanent object on shore, I took the levels from the town datum mark fixed to one of the steps of the Town Hall to the graduated staff fixed at the New Wharf in connection with the gauge. In his letter to me enclosing the remarks and tables, Captain Oldham says:—" From these observations the 'mean "tide level' is 8ft. 2·7 inches on the gauge, or 35·255 feet " below the datum mark on the Town Hall.

" Please note that these observations are only for one " month, and that, as probably the mean tide level varies at " different seasons, to get satisfactory results, a year's " observations should be obtained—this could easily be done " with an automatic gauge."

I am glad to say that this will be done, as the Hobart Marine Board is taking the necessary steps to procure and fix such a gauge. When it arrives I shall be happy to fix the graduated staff so as to coincide with the datum of Captain Oldham's observations.

The following are Captain Oldham's remarks and observations:—

"Remarks on Tides Observed at Hobart.

February and March, 1889.

1. The tides are subject to a large diurnal inequality; the highest high water is followed by the lowest low water, the tide then rises to a lesser high water, and falls to a lesser low water.
2. With the moon's declination north, the higher high water follows the superior transit of the moon; with the moon's declination south the higher high water succeeds the inferior transit.
3. The greatest range of tide appears to occur about two days after the moon has reached its greatest north or south declination, the least range when the declination is zero.

4. H.W.F. & C. occurs at Hobart at 8h. 15min. Springs rise { 3¾ to 4½ feet, and 2 feet. } Neaps 2½ feet.

REGISTER of TIDES observed at HOBART in the Month of FEBRUARY, 1889.

Day.		High Water.		Moon's Transit.	Bar at H.W.	Low Water.		Bar at L.W.	Wind.	
		Time.	Height.			Time.	Height.		Direction.	Force.
		H. M.	F. I.	H. M.	Ins.	H. M.	F. I.	Ins.		
4	A.M.	11·00	9·8½	..	29·85	..	..	..	W.N.W.	1
	P.M.	..	..	3·24	..	5·45	7·3	29·88	S.E.	3 to 4
5	A.M.	0·20	9·5	..	29·94	6·25	8·0	29·95	S.S.E.	1 to 3
	P.M.	11·20	8·9	4·10	30·06	6·25	6·11½	30·07	S.S.E.	4
6	A.M.	0·40	8·9	..	30·06	7·00	7·7	29·98	S.S.E.	3 to 4
	P.M.	0·30	8·3	4·53	29·93	6·30	7·4	29·83	South	3
7	A.M.	0·0	8·7		29·81	8·5	7·8	29·83	South	3
	P.M.	Not observed.								
8	A.M.									
	P.M.									
9	A.M.	3·00	9·0	..	30·22	10·20	6·5½	30·24	S.S.W.	1
	P.M.	4·00	7·8	7·6	30·24	7·30	7·4	30·24	S.E.	1 to 2
10	A.M.	3·20	9·3	..	30·05	10·20	6·10	30·05	Calm	0
	P.M.	5·8	8·4	7·52	30·08	8·50	7·11	30·01	S.E.	2 to 3
11	A.M.	3·25	9·4½	..	30·17	11·20	6·7	30·25	N.N.W.	1
	P.M.	5·40	8·0½	8·40	30·20	10·00	7·7	30·20	E.S.E.	2
12	A.M.	4·50	9·5½	..	30·18	12·05	6·8	30·15	N.N.W.	3
	P.M.	6·35	8·1	9·30	30·15	10·35	7·9	30·15	W.N.W.	4 to 6
13	A.M.	5·40	9·8½	..	29·83	..	..	..	S.S.E.	2
	P.M.	7·10	9·0	10·21	29·63	00·00	7·1	29·68	N.N.W.	3
14	A.M.	5·00	10·2	..	29·78	11·15	8·7	29·73	W.N.W.	4 to 6
	P.M.	7·55	8·6½	11·12	29·92	1·48	6·8½	29·89	N.N.W.	2
15	A.M.	6·40	9·8½	..	29·92	11·35	7·10½	29·95	W.N.W.	2
	P.M.	9·10	8·7	..	29·72	1·52	6·7	29·94	W.N.W.	1 to 3
16	A.M.	7·10	10·1	00·2	29·85	0·20	8·2	29·73	North	2
	P.M.	9·45	8·5	..	30·14	3·00	6·6½	30·01	S.W.	1 to 2
17	A.M.	8·30	9·1	00·52	30·27	1·40	7·8½	30·19	N.W.	1
	P.M.	10·25	8·0½	..	30·11	3·25	5·10	30·21	S.S.E.	3
18	A.M.	8·50	9·7	1·42	29·71	2·36	7·6½	29·95	N.W. by W.	1 to 2
	P.M.	11·00	9·2½	..	29·87	3·50	6·6½	29·74	W.N.W.	2 to 3
19	A.M.	9·40	9·4	2·28	30·08	4·20	8·0½	29·94	W.S.W.	2 to 5
	P.M.	11·35	8·7	..	30·25	4·40	6 7	30·20	North	1
20	A.M.	11·10	8·6	3·18	30·18	5·50	6·11	30·22	N.N.W.	1
	P.M.	..	..	..	..	5·52	6·5	30·14	S. by E.	1
21	A.M.	0·20	8·10	4·8	30·05	6·52	7·1	29·99	W.N.W.	1 to 2
	P.M.	0·30	9·1	..	29·91	6·30	7·5	29·80	S.E.	2
22	A.M.	0·40	9·10	5·0	29·81	7·40	7·0	29·87	S.W.	1
	P.M.	1·20	8·9	.	29·96	7·15	7·3	29·92	S.E.	2
23	A.M.	1·35	9·7	5·55	30·06	8·40	6·5	30·07	N.W.	1
	P.M.	2·50	8·7	..	30·03	7·45	7·8	29·99	S.E.	1
24	A.M.	2·30	10·1	6·55	29·67	9·40	6·11	29·60	N.N.W.	3 to 4
	P.M.	4·15	9·3	..	29·59	8·40	8·6	29·70	W.N.W.	4 to 6
25	A.M.	2·40	10·7	7·50	29·79	10·40	6·5	29·98	W.N.W.	1 to 3
	P.M.	4·55	8·11	..	29·96	9·35	8·2	29·98	N.N.W.	1 to 3
26	A.M.	4·00	10·4	8·51	29·93	11·15	6·4½	29·87	N.N.W.	1 to 2
	P.M.	6·15	9·2	..	29·67	10·15	8·4	29·51	North	2 to 3
27	A.M.	4·35	11·0	9·45	29·40	..	..	..	—	—
	P.M.	7·5	9·6	..	29·50	00·30	6·10	29·50	W.N.W.	2 to 4
28	A.M.	5·35	10·10	10·45	29·65	11·45	8·7½	29·54	North	5 to 6
	P.M.	8·5	8·6	..	30·29	1·25	6·4	30·15	W.S.W.	2
MONTH of MARCH.										
1	A.M.	7·0	9·6½	11·36	30·32	0·20	7·6½	30·33	North	1
	P.M.	9·0	8·6	..	30·25	2·15	5·11	30·28	W.N.W.	2
2	A.M.	8·5	9·6	..	30·20	1·30	7·6	30·22	N.N.W.	3 to 4
	P.M.	9·48	9·0	0·27	29·99	3·10	6·8	30·05	S by W.	1
3	A.M.	8·40	9·8	..	29·97	2·50	8·1	29·92	N.W.	1
	P.M.	10·30	8·10	1·14	30·11	3·50	7·0	30·02	S.E.	1
4	A.M.	10·10	9·1	..	30·08	4·5	7·6	30·10	Calm	0
	P.M.	11·15	9·2	2·0	29·84	4·25	7·3	29·87	N.W.	3 to 4
5	A.M.	11·00	9·4	..	29·63	5·20	7·9	29·47	N.W.	4
	P.M.	11·35	9·9	2·43	29·60	4·55	8·2	29·61	N.W.	3 to 4
6	A.M.	11·20	9·4	..	29·63	5·30	8·1	29·60	N.W.	2 to 3
	P.M.	..	..	..	..	..	..	..	—	—

Mean Tide Level from one month's observations is 8ft. 2·7in. on gauge, or 35·255ft. below datum on Town Hall.

For the purpose of more readily comprehending the information contained in these observations, I have prepared diagrams—the greater part drawn to scale—and setting forth:—

1st. The curve of tidal action for every day during which observations were taken, from the 4th February to the 6th March, showing the levels of high and low water in comparison with mean tide level, and the times at which they occurred.

2nd. The moon's course so as to show the times of superior and inferior transit of the moon's phases and apogee and perigee.

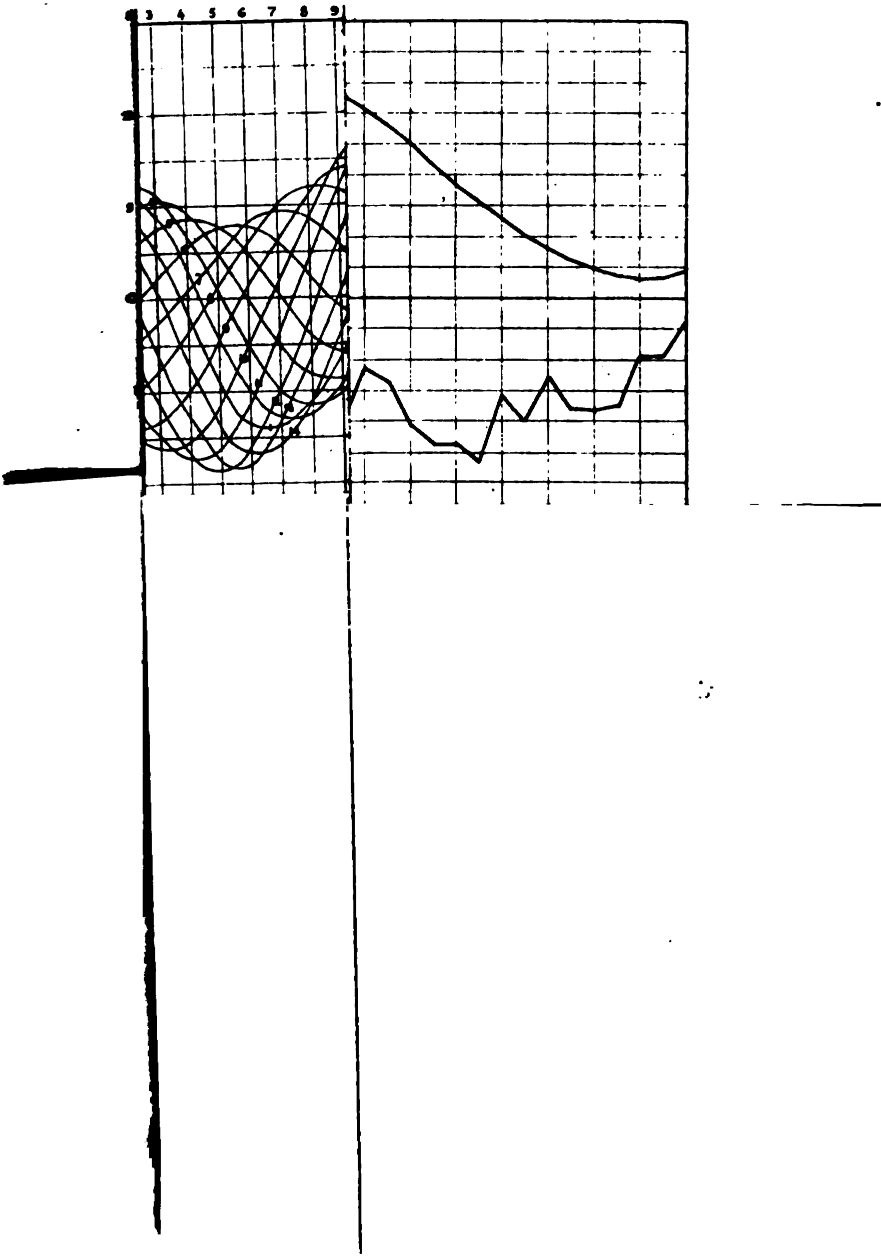
3rd. The moon's north and south declination.

4th. The intervals, called by Dr. Whewell "Lunitidal Intervals," of time between the moon's transits and the succeeding high water; the extreme intervals caused by the diurnal inequality being faintly marked, and the mean intervals more strongly.

5th. Wind force and direction at every time of high water; and

6th. Barometric pressure at every time of high water.

The graphic presentation of all these elements synchronically enables one to judge better of their influence upon the tide. The diurnal inequality of spring tides is not only shown, but is shown to follow the usual law, as pointed out by Captain Oldham, in connection with the north and south declination of the moon. Equally clearly appears the occurrence of springs at greatest declination, and not at new and full moon, so that at Hobart there is no "*age of the tide*;" and in connection with this the influence of perigee is shown in the higher tides at south declination. Captain Oldham's caution is very useful while looking at these diagrams that we must remember that we have here only one month's observation. But it is not likely that a year's observations will modify the above-mentioned facts. I believe they will be chiefly useful in showing that there is some regularity in the sequence and circumstances of the great apparent irregularities shown by these observations for one month. To show the nature and extent of these irregularities I have appended two diagrams showing for comparison a fortnight's tide curves at Hobart and a fortnight's at Bombay, and a diagram representing a normal curve of lunitidal intervals in contrast with the zig-zag mean line of such intervals at Hobart. These irregularities will, I think, show that no "*establishment*," that is—time of high water on the day of new or full moon—can be fixed, although on the month's observations Captain Oldham mentions 8h. 15m. At Hobart this is of no great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consequence, as the depth of water in the harbour is such that the comparatively small rise and fall of tide does not much affect sailing arrangements.

It is, however, very desirable that the observations to be taken should be as complete as those given by Captain Oldham, and I would press on the Society the desirability of co-operating with the Marine Board to secure this. The importance of the registration of the actual tidal action speaks for itself, and equally so does the necessity of comparing continually such action with the age and position of the moon. The force and direction of the wind have also an influence that must be noted. In connection with this I may mention that during this month's observations, as shown on the large diagram, the highest tides occurred with the wind blowing from north, and north-easterly points—that is more or less down the Channel. The barometer should also be carefully observed, if a mean sea level is to be fixed, as a fall of one inch in the barometer means a rise of 20 inches in the sea level.

Another important matter can only be secured by the co-operation of the Marine Board;—the progress of the tide wave round the coast. I would suggest that they be asked to get their lighthouse men to keep a register of the actual times of high and low water as nearly as can be ascertained by them during all the time that registers are being kept here. This is a matter of general interest.

I have to apologise to the Society for the presentation of such a meagre paper, but must plead the engrossing nature of my other occupations, and the time that the preparation of the diagrams has taken. But I hope I have said enough to show the desirability of pursuing investigation in this channel.

DISCUSSION.

Mr. A. G. **WEBSTER** stated that the Marine Board would be willing to render any assistance in its power.

Sir **LAMBERT DOBSON** said that a namesake of his, who was head-master of the High School, had manufactured an automatic tide gauge himself, and kept a register of tides for some time. He could not say when it was, but he thought it would be about 1853.

Mr. W. E. **SHOOBRIDGE** stated that at one time he used to register the tide in the Derwent, and found it varied very much, the lowest tides occurring about February and March.

His **EXCELLENCY** thought it would be very important to have the observations in regard to the tidal wave around the country. With regard to the point raised by Sir Lambert Dobson, he had been told by fishermen and others that low tides were a sign of fine weather, and high tides of bad weather, and if they had a series of observations extending over some time the value of them in this direction would be seen. He had thought the highest tides would have been experienced when high winds blew in through the Channel, keeping the water up, instead of finding the highest tides when the winds came from the N. or N.E., as Mr. Mault had stated.

ON THE ENCOURAGEMENT OF A MORE GENERAL INTEREST IN SCIENTIFIC PURSUITS.

By Wm. Benson.

The object of this short paper is to offer a suggestion for the consideration of this Society.

It is a very simple one, and perhaps ought rather to be made to the Council privately than be brought forward in a general meeting. But there seemed some advantage to be gained by mentioning it here, inasmuch as an opportunity would be afforded for ascertaining how far other members coincide in the views expressed.

Our Society unquestionably has rendered, and is now rendering, practical and substantial benefits to the colony at large, but I think it may be made of greater use, and may influence a still wider circle than is at present the case.

Also with regard to its meetings I venture to think that improvement is possible, which would increase their general interest and value.

There are amongst our members two classes—first our *savants*, or specialists, all more or less entitled to speak with authority on some particular branch of scientific enquiry; and secondly, there are those who possess a general acquaintance with and taste for such matters, but who have not thoroughly studied any special subject. It is as one of the latter class, and in their primary interest that I speak, having heard many say that they do not care to attend these meetings because the papers read are often abstruse, fragmentary and dry.

It is obvious that this want of interest arises from our want of knowledge; our previous acquaintance with the special subject brought forward has been to slight to enable us perfectly to follow the reader. The fault very rarely rests with him, for it is almost impossible briefly to handle in detail any scientific topic in a manner that can be readily comprehended by an unprepared hearer. Even the language is often strange, for diffuseness can only be avoided by the free use of technical and unfamiliar words.

So far as the meetings of the Royal Society are intended for the interchange of notes upon new discoveries between *savants* and specialists only, the reading of such papers is a natural and proper course, though it may still be questionable whether those who merely hear a technical paper read gain as full a knowledge of its contents as they would by studying it at leisure in the Society's printed proceedings.

But while I would not depreciate the value of such papers, which are and must be the most important that can come before the Society, yet I would urge whether papers of another kind might not also be encouraged.

In so small a community as ours the *savants* can never be numerous, but there is, or with a little encouragement there might be, a considerable number among us who would eagerly and intelligently enter on scientific pursuits if facilities were offered: and surely the fostering of this general interest, and the creation of a wide-spread scientific taste throughout our community are well worthy of any attention and assistance this Society can give. In the long run they will yield results of practical value, and also materially add to the prosperity and influence of the Society itself.

It must be remembered that opportunities for self-instruction in all local branches of science (by which I mean our local geology, botany, natural history and the like) are very few as compared with what have been provided for English students.

There every branch has not only its well-recognised and standard authorities, but also its popular text-books in which the subject is presented in a simpler and more approachable style.

Here our authorities are few, text-books hardly exist, and English works are in many cases unsuitable. We are at a great disadvantage in this respect, and are much more dependent upon the direct teaching of our scientists themselves, and for this reason I would ask this Society to consider whether means cannot be devised for affording instruction of a more elementary and general kind.

There must be not a few who sometimes attend these meetings, and very many others who at present never think of becoming members, to whom such opportunities would be welcome, and, who by means of such assistance, would be enabled to follow up chosen studies on their own account, and to take a livelier interest in the more advanced and specialised papers that are read here, which at present are too often, I fear, interesting only to a few.

It is not to be expected that we can inspire everybody with a love for scientific pursuits. The tastes and talents of many will always lie in other directions. But good only can result from any effort that may be made to encourage and develop such a love wherever its germ exists, and I do not see any other organisation that is as well qualified to do the work as this Society.

I want to see the rising generation more interested than they appear to be in the physical history of their native colony, its fauna and flora, and so forth. At present these subjects have attracted but little attention, though they are easily made attractive, and this neglect is largely attributable to the absence of accessible sources of information.

The taste for such studies when once acquired rarely leaves a man, and developes afterwards along the lines of his peculiar preference, and thus the whole field of scientific enquiry is gradually occupied, though only a few branches be specially taught at first.

At present the Royal Society occupies a somewhat isolated height, and my wish is to see encouragement offered to climbers from the lower level, and means of ascent provided.

Many plans might be proposed for carrying out such educational work, and the following suggestion may not be the best, but there is an advantage in having something definite before us to be amended if it cannot be approved, and therefore I would propose for consideration the desirability of initiating courses of popular lectures on scientific subjects to be delivered under the auspices of this Society. Such lectures might alternate with the ordinary meetings, and they should not be restricted to members, but be open to all who desired to attend. I do not know whether this room would be available. It is not spacious enough for a large audience, but doubtless if the attendance became considerable a suitable hall would not be wanting. Personally, having great faith in object lessons, I should like to see the Museum itself made use of on all occasions where its cabinets could be used as illustrations, and the lecture would be none the less valuable to the hearers, and might perhaps be less arduous to the lecturer if it were so delivered.

Another thing which might be attempted in connection with this Society is the formation of a Naturalist's Field Club, similar to what exists in Melbourne and other Australian cities.

These two suggestions are much alike in character, and both the lectures and the excursions might be expected to give rise to papers, for the discussion of which opportunity should be found, though of course not at our regular meetings.

One other matter might well interest this Society, but it is probably one which must originate with some individual privately, and need only be hinted at here. I mean the introduction of local science primers for school use.

Some may think such work, as is here suggested, too elementary for our Society to recognise.

This would be true enough if it were proposed to abandon the Society's present work, or to lower the standard of the papers submitted to its meetings. But the desire is to supplement rather than to subvert, and the hope is to obtain in the end a wider circle of contributors and papers, embodying more varied original researches.

Also, if there were any other organisation capable of taking the matter up, or if the work could originate spontaneously, I would not bring it before this Society's notice, but it seems to me a case where our recognition and help may make the difference between failure and success.

For years science stood apart. Its affairs were assumed to be above the popular understanding. But all that has now been changed, and in Huxley, Tyndall, and many others, we see men of the highest scientific rank taking the lead in bringing their chosen studies home to the minds of the masses. We need not fear that anything we may do will be *infra dig.*

Any proposal for delivering popular lectures, pre-supposes the presence amongst us of gentlemen qualified and willing to come forward as lecturers. That we have the qualified men none will deny, but it is not everyone who would be willing to devote the necessary time and thought to the preparation of such lectures as have been indicated, for it would involve much trouble, and at first, until public attention had been thoroughly aroused, there might appear to be too little interest manifested to warrant the effort. But I hope the love of science for its own sake, which animates all who have advanced any distance into its mysteries, may suffice to induce one or more of our *savants* to offer their services, and to permit the experiment to be at any rate tried. It is hardly probable that we should ever have a continuous succession of lectures all the year round, but if from time to time such series could be delivered, and if the Council of this Society could keep an open eye for any opportunity that may arise to interest the public, and especially the young, I have faith that good results will follow.

DISCUSSION.

SIR LAMBERT DOBSON said he had heard many lectures in his early days which had furnished him with a great deal of information, and which had been of great use to him since then. He was thoroughly in accord with Mr. Benson that the Society could be much more useful than it is at present. The start wanted to be made, and there was no reason why they should not have, say, half-a-dozen lectures in the course of a session. Geology was a subject which might well be introduced, and there were many other subjects which would be found both interesting and useful.

MR. JAMES BARNARD thought it would be very practicable to follow out the idea suggested by Mr. Benson, and he heartily supported and concurred in this.

The Hon. **Nicholas Brown** said there could be no doubt that if it were possible to carry out a system of popular lectures they would gather in a much larger interest in the proceedings of the Society than at present existed. He thought the Council of the Society should take the matter up and endeavour to ascertain whether or not it would be possible to give effect to the suggestions made by Mr, Benson.

Mr. **Mault** agreed with the suggestions contained in the paper, and especially the one relating to the formation of a Naturalist's Field Club, which could work during the recess of the Society. He would particularly urge this upon the Council, because during the summer months they would probably gain a good deal of knowledge through coming in contact with members of similar clubs from the other colonies.

The Rev. E. G. **Porter** (United States), on being introduced and requested by His Excellency to give some idea of the working of American societies, said he was cordially in sympathy with the objects of the Society and the paper which had been read by Mr. Benson. In America people were glad to study and glad to learn. They had many societies, and although none of them were "Royal," he thought they were doing "Royal work." (Laughter.) He gave an interesting account of the scientific work undertaken by the American societies, and stated that the results were that science became popular, and that large audiences could be secured at lectures, not only in the cities but in smaller towns.

Mr. **Morton** stated that the Technical School Board had already arranged for a course of lectures to be delivered in connection with the work of the schools. Dr. Giblin, at the special request of the Board, had undertaken to give a series of lectures on "Human Physiology." His lectures would be illustrated by means of an excellent collection of slides. As secretary to the Society he would take care that the suggestions contained in the paper should be brought before the Council.

Mr. W. E. **Shoobridge** thought the Society should also take up the question of advising in regard to text books suitable for schools.

The **President** (Sir R. Hamilton), in moving a vote of thanks to the readers of the papers, said he thought the suggestions made by Mr. Benson might be left to the Council.

A vote of thanks was carried by acclamation.

NOTES ON THE POSSIBLE OSCILLATION OF LEVELS OF LAND AND SEA IN TASMANIA DURING RECENT YEARS.

By Captain Shortt, R.N.

During the years 1883, 1884, 1885, and 1886, or immediately prior to the eruption at Tarawera, this island, and the South-Eastern portion of the mainland of Australia, were frequently shaken by earth tremors; and as such disturbances are often known to be associated with local changes of sea and land, it appeared to me to be of great importance to ascertain whether any recent change could be traced along the coast-line of this island.

This enquiry in a young colony is attended with many difficulties, as with one isolated exception, hereafter discussed, no definitely fixed tide marks are in existence by which satisfactory conclusion might be drawn.

The exception, however, is of peculiar interest, as it affords us some information, so far as the locality is concerned, in which this fixed tide mark occurs. The tide mark here referred to is situated on the North side of the "Isle of the Dead," which lies off Point Puer, Port Arthur. This mark was cut in the rock broad arrow form, on the 1st July, 1841, by the then Deputy-Assistant Commissary-General, Mr. Lempriere. The circumstances under which this mark was placed there is explained by Captain Sir James Clark Ross, R.N., in his work entitled "A Voyage of Discovery and Research in the Southern and Antarctic Regions during the years 1839-43." Thus Page 22:—My principal object in visiting Port Arthur was to afford a comparison of our standard barometer with that which had been supplied to Mr. Lempriere, the Dupty-Assistant Commissary-General, in accordance with my instructions; and also to establish a permanent mark at the zero point, or general mean level of the sea, as determined by the tidal observations which Mr. Lempriere had conducted with perseverance and exactness for some time; by which means any secular variation in the relative level of the land and sea, which is known to occur on some coasts, might at any future period be detected, and its amount determined. The point chosen for this purpose was the perpendicular cliff of the small islet off Point Puer, which being near to the tide register, rendered the operation more simple and exact; the Governor, Sir John Franklin, whom I had accompanied on an official visit to the settlement, gave directions to afford Mr. Lempriere every assistance of labourers he required, to have the mark cut deeply in the rock, in the exact spot which his tidal observations indicated as the mean level of the ocean.

I may here observe, that it is not essential that the mark be made exactly at the mean level of the ocean, indeed it is more desirable that it should be rather above the reach of the highest tide, and the exact distance above the mean level recorded.

The most desirable position for such another mark would be near the North-West extremity of the island, in the vicinity of Cape Grim.

Mr. Lempriere, it is evident, carefully carried out these directions, for on a tablet still existing a little above the tide mark in question is the following record. "On the rock fronting this stone a line denoting the height of the tide *now struck* on the 1st July, 1841, mean time 4 h. 44 m. p.m.; moon's age 12 days; height of water in tide gauge 6 ft. 1 in."

It is stated by my informant, Mr. T. Mason, that the words and figures underlined are nearly obliterated, and that he has given what they appear to be. It is unfortunate, also, that no other records can be found relating to Mr. Lempriere's tidal observations, although I have searched all local records. I have also applied to Capt. W. J. Z. Wharton, R.N., Hydrographer of the Admiralty, with the view of ascertaining if they had any records relating to Mr. Lempriere's observations at Port Arthur, but in answer I learn that no records of tidal observations have ever been received at the Admiralty.

Capt. Wharton at the same time informs me that the approximate time of high water on 1st July, 1841, was 5 h. 35 m., p.m., that is nearly an hour later than the apparent record on the tablet. If we now assume that the tide *now struck* refers to high water, which is most probable, we have some means of determining whether any change has since occurred in the relative levels of sea and land.

Mr. Mason, at my request, very kindly ascertained the time of low water on February 24th, 1888, at 11 h. 45 m. a.m., which day corresponds relatively with the moon's age 47 years previously.

At this low water level the mark was found to be 2½ ft. above. This very closely corresponds with the normal difference between these levels of low and high water, and would therefore indicate that there has been practically no alteration of the relative levels of sea and land during the last 47 years. This, however, only bears witness to possible movements in the Southern portion of the island. As regards the Northern portion there is no definite knowledge; but it is interesting to place on record, that Captain Miles has learnt from the half-casts in the Furneaux Group they have noticed within the last few years that there seems to be less depth of water over certain well-known rocks near the islands than formerly. This, however, if true, does not seem to have been a sudden change, but rather a slow elevating movement possibly still going on. As it is of the greatest importance to get more definite information with regard to this locality, I have already taken some steps to fix a tide mark on Flinders Island, so that in future years observations may be made upon some certain data that we at present possess.

It would be desirable also in the interest of Navigation to have such marks carefully made on various parts of our coast line.

It might be of value, therefore, if this important matter received the attention of the Members of this Society.

THE "IRON BLOW" AT THE LINDA GOLDFIELD.

By R. M. Johnston, F.L.S.

At the last meeting of this Society a paper, contributed by Mr. G. Thureau, F.G.S., was read, which calls for some observations from me. Before commenting upon the matters which have caused differences of opinion, however, let me express my sincere regret that any unfortunate remark of mine should have led him to suppose that I do not appreciate the scientific ability of the author of the paper in question. Having said this much, it will, I hope, be granted that the existence of differences of opinion upon geological matters which are obscure may nevertheless exist, and, in fact, continually happen—between the greatest names in science—without questioning the talents or training of those who may espouse irreconcilable opinions.

The differences of opinion as between myself and Mr. Thureau, fortunately, are not of a serious nature, and, according to Mr. Thureau's recent explanation, I perceive they are more due to the confused way in which descriptive terms are employed than to any real differences of opinion. The question between us has been altogether misconceived by Mr. Thureau, and even in his last paper he often leaves me in doubt whether he is referring (1) to the original agencies by which the original metalliferous deposit was formed, or (2) to the causes which produced subsequent modifications. If Mr. Thureau had discussed the Iron Blow question without confusing these two fundamental considerations it would have placed the issues between us in a very small compass. I shall endeavour to keep free from this confusion by discussing the two questions separately:—

I. (*a*) Under what circumstances and by what agency was the fissure formed originally?

(*b*) From *whence* and by what *agencies* were its present altered and unaltered contents derived?

(*c*) By what *mode* were the original matters deposited or obtained?

First, then, we have to enquire—

Under what circumstances and by what agency was the fissure originally formed?

The schists and conglomerates in which the great fissure occurs are evidently of Silurian age, and the forces which operated in dislocating them must, therefore, have been exerted not earlier than this period. From the abundant evidence at our command of crumpled, distorted, folded, and metamorphosed strata, common in rocks of this age, there is little doubt of the fact that the dynamic forces at work were far more potent than at present, although not different from forces still in operation, whose throes, like those of Krakatoa and Tarawera, are still mighty enough to produce vast local disturbances. There is little doubt in my opinion, therefore, that the fissure at the Linda was originally caused by the same dynamic forces which caused the dilating, folding, and metamorphosis of the crystalline rocks, and that these mighty effects were primarily caused by the gravitation of the outer crust towards the shrinking and cooling central mass of the earth. Mallet's lucid exposition of this theory, many years ago, has convinced the large body of geologists of the reasonableness of this; and I may be pardoned if I cannot discover any flaw in its sufficiency to account for all the dynamical phenomena observable at the Iron Blow.

The next consideration is—Was the opening of the fissure accompanied by the expulsion of heated materials from the interior of the earth by volcanic agency? This brings us to the second part—

From whence and by what agencies were the present altered and unaltered materials derived?

With respect to this question, I am still in accord with Mr. Thureau, for I am of opinion that the expulsion of heated materials from the interior of the earth by volcanic agency has occurred, and to this expulsion may be attributed the *immediate* cause of the opening of the Iron Blow fissure. My original suggestion, that the materials now forming the contents of the fissure does not "necessitate their having been formed originally in the way of 'volcanic mud,'" is incorrectly interpreted by Mr. Thureau as a denial of volcanic action.

This interpretation, moreover, is hardly warranted; for Mr. Thureau is well enough aware that elements such as barium, sulphur, iron and gold, now contained in the fissure are, and may have been, expelled from the interior of the earth as volcanic products by way of sublimation or heated solutions, or by both together or alternately. Mr. Thureau elsewhere admits this, for he states the discharges of the volcanic vents alluded to by him "leave a thin deposit or lamina in the 'cups' at the surface which, after hardening, was found on analysis to be chiefly charged with silica (quartz), and to also contain a sensible percentage of gold and silver." Now this deposit, it is clear by his own showing, was not composed of "volcanic mud" seen in ebulition as "a greyish semi-liquid mass . . . within the mouth of the 'fumaroles,'" but was essentially a *distinct chemical* *deposit formed from associated heated solutions.* If, therefore, this be the process—as Mr. Thureau avers it to be—"which assimilates a great deal to what can be seen in its '*dead state*' at our 'Iron Blow,'" it is Mr. Thureau himself who overthrows his own argument, for it is not "volcanic mud" which he likens to the baryta of the Iron Blow, but the silica found as "lamina in the cups" which, without doubt, by his own showing, was formed as a *precipitation from solution!* Where, then, is Mr. Thureau's logic in finding fault with me for preferring to believe the same thing in my statement, quoted by him, viz., "It is probable that the four principal elements—iron, barytes, sulphur, and gold—were originally *precipitated together from solution?*"

That there can be no mistake that the contents of the Iron Blow were considered by him to be the analogues of the silica precipitated from solution, and not the "greyish semi-liquid mass," is proved by the following sentence:—"If baryta is substituted for silica (as matrix?) in the latter case, the question of origin as to both metalliferous deposits is not only, in my opinion, very suggestive, but forms the only possible true solution of the case."

I am, of course, extremely gratified to find in this clear expression of opinion that he thus agrees with me that precipitation from solution is "the only possible true solution of the case;" for while it refutes his "volcanic mud" theory, it more firmly establishes my opinion "that the four principal elements—iron, barytes, sulphur, and gold—were originally precipitated from solution."

Besides this, there is no evidence at the Iron Blow to show that the respective solutions were in any way associated with a "volcanic mud" corresponding to the "greyish semi-liquid mass within the mouth of the fumaroles" of America, of whose composition Mr. Thureau's description does not afford us the slightest enlightenment.

Strictly speaking, mud is a term more appropriately applied to *mechanical mixtures* of various hydrous aluminous silicates, and *such mixtures* are fundamentally different from the definite *chemical compounds, pyrites* and *barytes,* which form the characteristic contents of the lode at the Iron Blow.

Causes which produced subsequent modification of materials as originally precipitated.

This part of the subject does not concern me so much as Mr. Ward, who is well able to defend his own views. I may, however, be allowed to observe that Mr. Thureau's denial that the soft and pulverulent combination of iron peroxide and barium sulphate of a deep purplish colour, together with the still more modified massive blocks forming the cap of this part of the lode, have been derived by subsequent decomposition of the parts more exposed to decomposing agencies, is a most unsatisfactory position for him to assume. It is not true, as stated by him, that the iron pyrites contain "no baryta to speak of." At page 218, "Royal Soc. Proc., 1886," the analysis given by Mr. Ward shows iron bisulphide pyrites, 83·0 per cent.; barium sulphate (barytes), 17 per cent., *i.e.*, actually 2·85 per cent. *less* than the decomposed pulverulent mass, which Mr. Ward, no doubt, rightly attributes to oxidation of pyrites.

Mr. Ward nowhere states that the entire mass of pyrites has undergone decomposition. On the contrary, he refers to the exposed surface of one portion of the original lode. The very fact that the undecomposed pyrites analysed by him was stated to be taken from a section described as two chains wide is proof that this is so. Mr. Thureau's most extravagant allusion to the fissure collapsing in consequence of a partial decomposition is therefore too preposterous to dwell upon. Has Mr. Thureau ever known pyrites, long exposed in lodes to air and water, not to have suffered from decomposition? That both decomposition and recomposition in mineral veins are among the most common of all occurrences cannot reasonably be disputed. Geikie, surely, may be trusted in a simple matter of this kind. At page 597, "Text Book of Geology," he states:—"It has been noticed that the 'country' through which mineral veins run is often considerably decomposed. In Cornwall this is frequently very observable in the granite. Moreover, in most mineral veins, there occurs layers of clay, earth, or other soft, friable, loamy substances, to which various mining names are given. In the south-west of England the great majority of the remarkable minerals of that district occur in those parts of the lodes where such soft earths abound. The veins evidently serve as channels for the circulation of water both upward and downward, and to this circulation the decay of some bands into mere clay or earth, and the recrystallisation of part of their ingredients into rare or interesting minerals are to be ascribed." So much for decomposition. Mr. Thureau, curiously enough, makes no allusion to the remarkable strings and veins of solid barytes penetrating the decomposed part of the lode. He would find it a difficult task to account for these strings on the assumption that they were formed contemporaneously with the pyrites mass, or even with the decomposed portion of the original lode.

Mr. Thureau's inexactness is also conspicuous in his references to baryta. In the first part of his paper, referring to iron pyrites (bi-sulphide), he states that it contains "*no* baryta to speak of," and yet he had Mr. Ward's analyses before him proving that it actually contained 17 per cent. of baryta, thus:—

IRON PYRITES.

(Section: 2 chains wide.)

	Per cent.
Iron bi-sulphide (pyrites)	83·0
Barium sulphate (barytes)	17·0
	100·0

The only difference of composition between the pyrites and the purple rock is due to oxidation of pyrites, thus:

	Per cent.
Iron peroxide	77·75
Barytes	19·85
Water, etc.	2·40
	100·00

It will be seen, therefore, that the derivation of the one from the other is not such an inconceivable matter as Mr. Thureau was led to imagine from his inaccurate interpretation of the data at his command.

Mr. Thureau again makes a curious reference to the baryta of this purplish rock, in his expression—"Now it is a *fact* that baryta is the 'matrix' of that purple rock." How baryta can be the "*matrix*" of the larger constituent iron peroxide (the latter being nearly four parts iron peroxide to one part baryta) is a puzzle to me.

The word *matrix* is usually employed by geologists to designate the rock or *main substance* in which a crystal mineral or fossil is embedded. According to this meaning of the word, Mr. Thureau is far from correct in stating that "it is a fact that baryta is the *matrix* of that purple rock."

MUD VOLCANOES.

As regards mud volcanoes, there are two well-known kinds, both of which differ widely in characteristics from the phenomena associated with the deposits of the Linda Iron Blow.

The first kind is not volcanic in the proper sense of the term, although variously named *mud volcanoes*, *salses*, *air volcanoes*, and *macalubas*. Geikie describes these as forming groups of conical hills formed by the accumulation of fine and usually saline mud. They are distinguished from true mud volcanoes in having their chief source of movement in the escape of gases due to underlying chemical changes, usually carbon dioxide, carburetted hydrogen, sulphuretted hydrogen, and nitrogen. The mud is usually cold.

The true mud volcano occurs in volcanic regions proper, and "is due to the escape of hot water and steam through beds of tuff or some other friable kind of rock. The mud is kept in ebulition by the rise of steam through it. As it becomes more pasty the steam meets with greater resistance; large bubbles are formed which burst, and the more liquid mud below oozes out from the vent."

These true mud volcanoes, in my opinion, neither in their mode of appearance, nor in their characteristic contents, show the slightest correspondence with the metalliferous fissure lodes of the Linda district.

I may mention that although my examination of the various lodes in this district was necessarily limited, they occupied my close attention for the better part of three days, at a time when they were well exposed by working operations.

DISCUSSION.

MR. W. F. WARD, Government Analyst, said:—

The point under discussion is the origin of the "formation" known as the "Iron Blow," the oxidised portion of which was described by Mr. Thureau as "volcanic mud or ash." Mr. Johnston, however, from close examination on the spot, and I myself, from the "internal evidence" yielded by specimens, etc., attribute to this a non-volcanic origin.

The materials of this formation are (1) barytes, sulphate of barium, or heavy spar, (2) iron pyrites, or disulphide of iron, (3) hæmatite, or sesquioxide or peroxide of iron.

I will glance briefly at the usual modes of occurrence of each, as showing in the first place that they are *not usually* "volcanic products."

1. "Heavy spar" occurs commonly in connection with beds or *veins* of metallic ore as part of the "gangue" of the ore.

It is found crystallised in the Cumberland hæmatite mines in the carboniferous limestone, and as much as 14 per cent. of sulphate of barium has been found disseminated in hæmatite from another district.

2. "Iron pyrites" is very widely distributed and abundant in rocks of all ages. By the decomposition (by the action of water and air) on the large scale of masses of pyrites, deposits of brown iron ore may be produced, sulphur being lost and oxygen and water taken up by the iron, and a very moderate heat suffices to convert this hydrated brown oxide into the red oxide or hæmatite by driving out the combined water.

3. "Hæmatite" occurs in many forms differing in texture and state of aggregation as: (*a*) crystallised, forming

"specular iron;" (*b*) fibrous, red hæmatite; (*c*) earthy, ochre, but all consisting essentially of peroxide of iron.

In the Cumberland deposits are found hard or "blast" ore, and soft, or "puddler's" ore, from its use in the puddling furnace: the hard, fibrous, and more common form often passing into the crystallised condition.

In Elba, hæmatite occurs crystallised between talcose (or perhaps hydro-mica) schists and crystalline limestone, and the crystals are frequently associated with iron pyrites. It is also found with other minerals as an abundant component of mineral *veins*, also in beds interstratified with sedimentary or schistose rocks.

On the other hand "specular iron" in some cases is a result of *igneous* action, is abundant around some volcanoes; and as pointed out by Mr. Thureau, scales of specular iron were found with 15 other minerals in "ash" from Cotopaxi.

To return to the formation, and quoting Mr. Thureau, we have "An immense bed or vein of solid pyrites filling the greater width of the fissure on its hanging wall, or about 225 ft. out of a total width of 280 ft. between walls of that chasm." Also "A soft purply pulverulent mass of oxide of iron about 56 ft. wide" on the *foot-wall.*

Now, as we have already seen, the pyrites decomposes sooner or later according to circumstances, and Mr. Thureau himself found "elongated and spherical nodules, which on examination were found to contain within hard crusts of sesquioxide of iron (hydrated), nuclei of pure iron pyrites . . . the nodules being in very close contiguity to the massive pyrites vein or bed;" these showing that, as might be expected, decomposition is still taking place.

To the analysis made by me in connection with Mr. Johnston's original paper, I appended a note that "there seems little room for doubt that the 'Iron Blow' is the result of oxidation of pyrites similar to that now associated so largely with it; the hydrated oxide first formed subsequently losing its combined water," and I was not a little influenced in forming this opinion by finding 17 per cent. of sulphate of barium intimately mixed with the pyrites, and 20 per cent. of that substance, *in similar condition*, intermixed with the peroxide of iron. This sulphate of barium Mr. Thureau claims to have "first discovered as the necessary adjunct to the gold." While, however, Mr. Thureau ignores or misquotes the evidence from the presence of this common constituent, and also deprecates forming opinions from the examination of specimens only, he yet advances as a most, if not *the* most, cogent argument in favour of "volcanic agency," the "almost non-auriferous" character of the scraps of pyrites assayed, as contrasted with the high result of assay of one sample of the oxide of iron. In addition, he calls in to explain the presence of this always irregularly distributed metal gold, as I contend, quite unnecessarily, "a more drastic process of origination than simple and quiescent decomposition only," applying this only to the oxide of iron and not to the bulk of the pyrites which fills four-fifths of the same "chasm."

To return for a moment to the nodules of decomposing pyrites found in the Blow itself, to quote Mr. Thurean again, "these present, neither more or less, former gaseous bubbles surcharged with vaporous sulphuretted solutions of iron becoming rigid when cooled, elongated or rounded by compression." This form is almost certainly also due to decomposition which, acting more rapidly on edges and corners of irregular fragments, more or less rounds them off.

In conclusion, therefore, I maintain that ordinary processes of decomposition are sufficient to account for all the phenomena presented by the oxide of iron portion of the formation, and that there is no necessity to invoke "a more drastic process of origination strictly speaking volcanic."

The **Secretary** (Mr. A. Morton), read a letter received from Professor Liversidge, Sydney University, in which he stated that his impression formed upon Mr. Thureau's paper, and without having specimens before him, was that the Iron Blow was not of volcanic origin. It would be almost impossible to form a decided opinion without actual examination of the Blow.

NOTES ON A CASE OF POISONING THROUGH EATING A PORTION OF THE "BRUGMANSIA."

By Dr. Hardy.

The case which I bring before you is one of poisoning through eating a portion of the common trumpet flower (Brugmansia) now shown to you.

This plant belongs to the order of solanaciæ and is therefore allied to a number of others which are recognised as poisons for example: stramonium, belladona, tobacco, also potato and tomato. These latter being classed as poisons appear at first sight contradictory, but although the tuber of the potato is wholesome when cooked, the leaves and other parts of the plant are poisonous.

Stramonium and belladonna, although in common use as medicines, are highly dangerous if taken in improper doses.

The potato is a powerful narcotic and has been used in rheumatism, while henbane is in common use as a sedative in irritable conditions of the brain.

With these introductory remarks I will narrate the case in question:—

On Thursday last a child, aged 2, after having a good dinner and appearing in perfect health in all respects, ate a portion of a trumpet lily, which had been picked in the garden of a gentleman living in this town. Within a short time symptoms manifested themselves, and I was called in to what the messenger described as a case of convulsions.

On examining the child I was struck by certain peculiarities in the symptoms unlike those of ordinary convulsions. The child's face and greater portions of the body were red, the eyes staring and the pupils widely dilated, the head and shoulders bent back, and the position almost that usually seen in tetanus or lockjaw; the feet pointing inwards and the great toes drawn up and stiff, an appearance of fear in the face and starting at times as if afraid of falling off the nurse's knee and finally arms moving irregularly, power of co-ordination partly lost, and the hands picking at imaginary objects. I was struck by the resemblance to a case of poisoning in a child by drinking some belladonna liniment, which I attended some 8 or 10 years ago, and so questioned the mother as to whether any medicines of any kind had been lying about.

However, no such cause was to be found but she said the child had been eating the plant she produced, which is said to have a pleasant taste. Under prompt treatment the child improved and next day was nearly well, and on the following day apparently none the worse for its botanical experiments, but the parents have decided not to grow a trumpet lily in their garden, as they had intended doing. I have heard that a similar case occurred here some years ago, but have been unable to find out the particulars, or how the case terminated. My object in bringing forward this case, apart from the scientific interest, is, that although proverbially "a little knowledge is a dangerous thing," still, the knowledge of the unsuspected dangers existing in our gardens is of interest to those of us, like myself, having children of an inquisitive turn of mind

NOTES ON ANGORA GOAT FARMING.

By James Andrew.

This is not the first occasion on which the advantages and profits of Angora goat farming have been brought under the notice of the Royal Society of Tasmania, but as fifteen years have elapsed since the late Mr. John Swan read a paper on the subject, and the Honorary Secretary, Dr. Agnew, laid upon the table a letter with covering correspondence from the British Consul at Angora, giving particulars of the industry as conducted in Asia Minor, I may be excused for re-opening the question.

Since 1874, when this effort was made to stimulate popular interest in favour of a fair trial, in Tasmania, for a description of stock farming elsewhere found so profitable, little or nothing has been done; and although a few very small flocks of indifferently bred goats still remain in the colony, they do not appear to receive the attention they merit, and mohair, as the fleece of the Angora is termed in trade returns, does not figure amongst our exports.

It is my aim in submitting the following notes, to revive if possible the spirit of experiment which induced Mr. Swan—an experienced flock owner—to advocate the claims of goat farming as worthy of careful consideration.

In Asia Minor, the natural habitat of the Angora goat, whence the progenitors of all the stock now found in America, Africa and Australia were obtained, the hair of some of the best flocks, which is invariably pure white, was at one time so highly valued that its export was prohibited, and later, permission was granted to send it out of the country in a manufactured state only. At the present time the value of the hair exported from the province amounts to £200,000 per annum, which, however, is far exceeded by the production of other countries in which goat farming has become a settled industry.

The Cape Colony owes the introduction there of Angora goats, in the first instance, to a Colonel Henderson of Bombay; afterwards some were forwarded to the colony through Sir Titus Salt, who was the first English manufacturer of textile fabrics from their hair, and later Messrs. Mosenthal Bros., in the year 1856, secured some pure bred animals from Asia Minor. Since then there have been many private importations of stud stock, one of the most important of which was that of a Mr. J. B. Evans, who personally selected goats in the mountain districts round Angora.

This was in 1880, and in the following year I had an opportunity of inspecting some of the rams—which had sold at from £100 to £200 each—in the Graaf Reinet and Eastern districts. It was in 1862 that mohair first appeared amongst Cape exports, the quantity being 1,036 lbs., in 1865 the export was 7,000 lbs., valued at £368, but in the next decade the increase was marked, the figures being 1,148,000 lbs., valued at nearly £135,000; still another ten years, and although the clip was more than quadrupled, being 5,250,000 lbs., the price obtained for it had suffered great depreciation, the value being only £204,000.

The last published returns for 1887 show weight of hair exported 7,154,000 lbs., worth £268,500, a fall in price of 1d. per lb. on the previous year's clip. In addition there must be taken into account the value of exported skins during the same year, viz., £100,000, and even these figures fail to represent the total value of the products of this useful animal, as a large quantity of skins and leather are absorbed by home consumption. It is further necessary, when estimating the economic value of Angora goats, to remember that the meat of the wether or "kapata," as it is called in the Cape Colony, is excellent. Sir Samuel Wilson, to whose monograph on "The Angora Goat" I am much indebted for information, states that:—"Its flesh when in good condition is not inferior to mutton." He adds, "I have eaten the flesh of a half-bred which could not be distinguished from mutton, even in the carcase, and which on the table was considered quite a luxury." Further testimony is born by a Victorian sheep-owner of repute, who in February, 1873, reported to the President of the Acclimatisation Society in that colony that:—"Last winter I killed two wethers, full mouthed, which each weighed when dressed 80 lbs., the flesh of which when put upon the table was pronounced most delicious, being more rich and juicy than the best Merino mutton." I can fully endorse, from a somewhat lengthy experience of goat's flesh as an article of diet, all that these gentlemen say in its favour.

At the date of the compilation of the last returns the number of Angora goats in the Cape Colony was 2½ millions, and the other countries of South Africa, Natal, the Orange Free State, and the Transvaal also maintain a considerable number, and mohair is an important item of their exports.

A Mr. Scott of South Carolina, minister to Turkey in 1848, was the first to take Angoras to America, and there have been many subsequent importations; but the industry has never assumed the proportions attained in South Africa. I have not been able to obtain any recent returns, but from evidence given before the United States Tarriff Commission in 1882, it appears there were then an estimated number of 100,000 goats in the country, yielding hair of over 200,000 lbs. weight per annum.

Flocks are now to be found in various states of the Union, in very varied climates, such as Oregon, Wyoming, Colorado, Texas, California, Missouri, and Arkansas, whilst an absolutely pure flock is owned by a Colonel Peters in Georgia.

For some years the growers in the States maintained their flocks under great discouragement, as the demand there for such fabrics as the hair was used for, fell off very rapidly. But the introduction of new materials gave a fresh impetus to their energies, and, to again quote the Tariff Commission, "The supply produced in the States, if multiplied threefold, would not be sufficient to furnish material for the plushes now used in the railroad cars of that country alone."

The industry had hardly been successfully established in the Cape Colony and America when steps were taken to introduce Angora goats into Victoria. A small flock was purchased at Broussa, near Trebizond, and shortly after arrival in the colony they were transferred to the care of the Acclimatisation Society. An addition to their number was made in 1863 when twelve pure rams of a very high-class were received as a present from the Imperial Acclimatisation Society of France. Two years later a further shipment of 93 carefully selected animals was forwarded from Asia Minor, *via* London. These cost the Society about £16 per head.

As the numbers increased the accommodation at the Royal Park, Melbourne, was found too limited, and the flock was dispersed in 1870. A large number of the inferior animals were sold, the price being fixed at five guineas per head—less than their actual value — but about fifty of the choice animals were sent to the Wimmera district to the care of Sir Samuel Wilson, who three years later reported:—"The flock of Angora goats now on the Wimmera is 108 in number besides a few young kids. From calculations carefully made this small flock, if well managed, and sufficient pasture allowed it to graze upon, will at the ordinary rate of increase reach in thirty years the very large number of 442,368. This number should be sufficient to displace all the common goats in the colony. In forty years at the same rate the pure flock would increase to over seven millions."

But to contemplate obtaining a flock of Angoras by depending on the natural increase of such pure bred animals as could be secured for a moderate expenditure of capital would prove both tedious and disheartening, and we have the pronounced success of cross-breeding in other countries to guide those who may be desirous of commencing the industry. It has been found that the progeny of pure Angora rams and common goat ewes, produce in the third generation—the sire in each case being of pure stock—animals, which in appearance and characteristics are hardly to be distinguished from their male ancestors. Every succeeding cross more nearly approaches perfection, but the plebian taint is almost completely eliminated, and quite sufficiently so for commercial purposes, in the fourth generation. No matter what the colour of the female goat, black, brown, or grey, her offspring present the male characteristics to a pronounced degree, and in the third cross nearly every trace of colour has disappeared.

Thus a stock-farmer has at his disposal practically unlimited scope for increasing his general flock. It is manifest, however, that a small stud herd would have to be maintained to keep up the supply of pure bred males, which are of course alone used for breeding purposes, and the purchase of a few carefully selected Angora ewes would therefore be necessary. Many objections and as many defences of cross-breeding have been ably discussed at various times. On this subject Sir Samuel Wilson writes :—" It is stated by Mr. V. A. Niessen that the hair from the half-bred Angora is worth a shilling per pound, that from the three-quarter-bred, one shilling and sixpence per pound, that of the third cross, or seven-eighths-bred, would nearly equal in value that from the pure bred, and the fleece of the fifteen-sixteenths, or fourth remove, would be quite equal to that of the sire in purity, lustre, fineness, and length of fleece." He quotes also a letter addressed to the President of the Victorian Acclimatisation Society from the Hon. Robert Simson, "a large sheepowner, and a distinguished breeder of the Merino," dated 18th February, 1873, who enclosed samples of hair from descendants of three-quarter-bred ewes from the Cape Colony, and a pure bred ram. In regard to which Sir Samuel states :—" The specimens were all of excellent quality and excepting a greater degree of lustre which those from the pure bred Angora exhibited, they appeared so equal in value as scarcely to be distinguishable from each other. On the question of the cross between the Angora and common goat, I am ready to admit that crossing with the Angora, with a view gradually to improve the common goat, may produce valuable results; I wish it to be clearly understood that such animals or their progeny, even if pure sires be used for a thousand generations, can never become pure bred. The stain can never be washed away. Each cross with the pure blood reduces it by one half, but as division is infinite it never entirely disappears."

Theoretically, Sir Samuel Wilson's views are no doubt correct, practically, in connection with goat farming, they are unworkable. In the Cape Colony all the flocks, now numbering 2½ millions, have been raised by cross breeding, and a similar course has been followed in the United States with equal success; indeed, Mr. John Swan stated that he was informed, "the best flock in America never contained a pure bred female." Sir Titus Salt, too, is known to have raised a flock in this manner in England.

I sincerely regret that my specimens of hair, from a celebrated flock of goats in the Graaf Reinet district of the Cape Colony, have so suffered from moth during eight years' inattention that they but very imperfectly exhibit the gradations of successive crosses and the perfect sample which it is the aim of every flock owner to equal. They may, however, suffice to give some idea of the various grades through which animals with fleeces of good enough quality for a general flock are obtained.

It is hardly necessary to remark that the degree of attention given to the selection of the best stud rams, the proper classification of ewes, and the systematic culling of flocks, will determine the value of the staple product.

The fleece of the pure bred Angora often reaches to the ground, the locks measuring 12 or even 14 inches in length. The kind most in demand is only so much matted as to cling together near the root, remaining free and separate to the tip. The weight of hair varies as much in different individuals as does the yield of wool in sheep. Mr. Swan exhibited samples from the fleece of a pure goat which weighed 8 lbs. 10 oz. realising 2s. 6d. per lb. in the Home market; but perhaps 5 lbs. may be taken as a fair average of a well-kept grade flock shorn once a year. From my notes taken during shearing time at Graaf Reinet I find that ewes cut as much as 6¾ lbs., whilst a ram was relieved of an 8 months' fleece weighing 7 lbs. Kids of 8 months old cut an average of 2 lbs. of very fine hair.

Sir Samuel Wilson advocated shearing twice a year, and his returns shows that the general average of both clips, the first in May, the second in October, was over 3¾ lbs. Even although the expenses are largely increased there may be much to be said in favour of this double clip, for, as if unshorn the goat naturally sheds its hair in early spring, it is found necessary to remove the fleece—if only one shearing be adopted—in mid-winter when its protection is most required. The growth in the former case is probably stimulated by Nature making an effort to provide for the wants of the animal; and felting or matting is no doubt prevented by not allowing the hair to attain full length. For manufacturing purposes any staple over 4 in. in length is found sufficient, so that the shorter clip is not detrimental to the value of the fleece

Shearing in South Africa is generally conducted in what, in Australia, would be considered a most slovenly manner. It is not unusual for a farmer to have the work done in the "kraals," or yards, and even if under cover the floor is more often than otherwise of earth. Goats are less troublesome to shear than sheep, but owing to the decided "lay" of the hair, men who can use both hands equally well have a considerable advantage. Sorting is, as a rule, very inefficiently carried out.

About the 1st June is the usual date for commencing opèrations, and in the Karoo, where a large proportion of the Angoras in the colony are kept, the nights at that time of the year are often bitterly cold. Bad weather immediately after shearing may cause terrible mortality amongst a flock if proper precautions are not taken, but the general conditions affecting stock farming are comparatively so unfavourable in the country alluded to, that but little harm need be anticipated in Tasmania. Cold alone does not appear to have a particularly bad effect, nor does a warm shower of rain; but cold and wet together are very destructive and should be carefully guarded against by providing shelter. In the Cape Colony all flocks are "kraaled" or yarded at night for protection against wild animals and depradatory natives, and slight shelter is often contrived for newly shorn goats, but in the Karoo there is no scrub or timber to afford a friendly lee should the flock be caught in a storm during the daytime, and thus the mortality is often great.

Goats are much more prolific than sheep, but Angoras less so than the common species, still a very large percentage of the ewes bear twin kids. The young are at birth very helpless, in marked contrast to lambs, and remain so for ten or twelve days, and as the ewes display maternal instinct in a very modified form, some trouble may be anticipated at this time, which is usually between August and October. Here, again, experience gained in South Africa is of little value when applied to Tasmania, but the advantages are all in favour of the latter, as the ewes would here be disturbed as little as possible until their kids gained strength and intelligence.

Mr. Swan states that:—"The trouble and expense of managing a flock would be less than that required for sheep. Goats are much more intelligent and are less liable to destruction by dogs." He adds:—"No ordinary fence will restrain them, and as they are restless, energetic, and destructive, cultivation is not profitable in their vicinity. Hawthorn hedges and ornamental shrubs possess peculiar attractions for them." Mr. Swan further remarks :—"They have great attachment for home and can be depended upon to return to their sheds at night. Shelter should be provided for them, as they evince great aversion to rain and will remain under cover all day in wet weather."

There is no reason whatever why, if the goats kept here or in other colonies become very numerous, the area of pasturage available for sheep need be encroached upon. Indeed, the reverse would be found to be the case, as Angoras have been proved to be excellent pioneers in clearing up new country for sheep and cattle, and they not only do not injure but positively benefit other stock, especially sheep. An immense amount of land now almost, if not quite, valueless could be utilsed for goat farming, for these animals will live and thrive where others would starve, and mountainous, scrubby, and wooded country, barren ranges, and heathy plains are alike suitable for their requirements; and by their activity, superior intelligence and fearlessness, they obtain sustenance where sheep would be incapable of venturing. They are also, with the exception of a short period immediately after shearing, as indifferant to climatic as they are to dietetic influences. In further reference to the latter there is one very important point to notice; they appear to suffer no inconvenience from being depastured on country where plants abound which, when eaten by sheep, prove fatal. In South Africa I know this is the case and Sir Samuel Wilson bears similar testimony, stating :—"Its freedom from disease, its activity, and endurance, and ability to feed on shrubs, bushes, weeds, and even poisonous plants with impunity give it a special value as the animal suited to the selector or the small freeholder with limited means."

It has been conclusively proved that the climate, as well as the pasturage and herbage of Australia and Tasmania, are peculiarly suitable for goat farming. No large outlay is required to form the nucleus of a flock, nor is any special knowledge requisite for their management; there are vast areas of vacant land awaiting settlement, and the inquiry naturally suggests itself how it is that the industry has failed to command the attention here or on the continent of Australia, which it has received elsewhere.

If some one of enterprising spirit will embark a few hundred pounds in such a venture the investment will, I am confident, prove remunerative. Islands are peculiarly adapted for the purpose, as secure boundary fences are naturally provided, and subdivision can often be arranged with the minimum of material.

There is one which I can recommend for tentative occupation, viz., the West Hunter Island to the north-west of Tasmania, in Bass Straits. It has an area of 20,000 acres, most of which is rough feed very suitable for goats, and it may be rented from the Crown for £20 per annum on a 14 years' lease. Sheep cannot be kept there as the "lobelia" or poisonous tare of King's Island abounds and invariably proves fatal. The last attempt at stocking this island of which I have any knowledge was in 1882, when 600 ewes were placed there as an experiment, of which only 30 survived in about 6 months' time. The same plant has proved most disastrous to the efforts made to depasture sheep on King's Island, and if my conviction as to the immunity of the goat from its evil effects prove correct—and at least an inexpensive trial might be made—there is practically unlimited scope for many years to come in the unstocked islands of the Straits for the development of goat farming.

On the coast in various parts of the colony there are large heath-covered plains which may be similarly utilised, and experience might show that even the much-abused button rush country can be turned to account. Perhaps the energetic gentleman who has obtained the lease of Maria Island from the Government may be induced to set apart the southern end as a goat farm; the ground is poor, can maintain only few sheep, but has considerable capabilities as pasturage for the more active animals which feed principally by browsing.

The Tasmanian Stock Regulations at present in force absolutely prohibit the importation of goats from any place outside the Australasian colonies, but there are, no doubt, some perfectly pure bred Angoras to be secured in Victoria, New South Wales or South Australia, where small flocks are maintained. The common goat ewes are not difficult to obtain.

A certain amount of surplus stock must accumulate until after the third or fourth cross, when the hair of all should be of nearly equal value. The skins of such half-bred or three-quarter-bred "kapatas" or wethers as are killed for meat will be found for tanning purposes of far greater value than sheepskins, the leather being substantial and of attractive appearance. When the goats are killed carrying a medium length of fleece the skins make excellent and most ornamental mats, whether dyed or left of their natural colour, and find purchasers at all prices up to £1 each.

Goats have much more intelligence than sheep, are easily trained, and the employment of "voorboks" or leaders, kapatas of the common breed—chosen for size and strength—is infinitely better than to attempt working a flock with dogs. These leaders are considered indispensable in South Africa, they march in the van on making for the feeding ground in the morning, and lead the way home at night. As decoys for yarding the flock at shearing time they are invaluable, and I have known them pilot slaughter stock on board vessels in the Cape Town docks without the least difficulty. Being of an otherwise valueless breed and having no fleece worth shearing they are consequently rarely handled and so losing all timidity amongst men they fully enjoy the dignity of their position.

Enquiries I have made to ascertain particulars of the Angora goats still remaining in Tasmania have not been successful. There is some reason for suspecting that attempts previously made here, and perhaps in the other colonies, to establish the industry have not been so successful as otherwise might have been the case, owing to the goats having been kept on open grass country. This is clearly a mistake. Rough, mountainous and scrubby ground is far more suitable, and it is with a view to encourage the occupation of such districts and so assist to a small extent in developing the natural resources of the colony that I venture to recommend the farming of Angora goats as an industry quite worth a patient and careful trial.

PROTECTION OF TASMANIAN OWLS.*

By Col. W. V. Legge, R.A.

I desire to bring to the notice of the Fellows of the Royal Society to-night the advisability of protecting the owls of Tasmania, inasmuch as they are the most useful vermin-killers of any known family of birds, while at the same time no birds are more persecuted by well-meaning people through ignorance of their true mode of life and also by pot-hunters in search of so-called sport. It is thought by the majority of people that owls destroy birds to a great extent, whereas, in reality, there are few species of this large family which are partial to birds. Owls are either twilight or night feeders, at which time vermin or other small animals are chiefly about, and, therefore, in the economy of nature, they form the natural food of these birds.

Any of us who have studied works on British ornithology are, perhaps familar with the story of the farmer who, missing his pigeons from his dovecote night after night, laid in wait with his gun, knowing that a pair of barn owls inhabited his premises, and shooting at the supposed offender, whom he caught issuing from the pigeon-house, brought him down with a huge rat in his talons.

The large owls which kill birds in any quantity, such as the genera *Bubo*, *Surnia*, *Nyctea*, and others are absent from Australia and Tasmania, and in fact the only species in this quarter of the globe which feeds much on birds is the large hawk owl, *Ninox Strenua*, Gould, of Eastern and Northern Australia. We have only three species in this island: the well-known chesnut-faced owl, *Strix Castanops*, Gould, belonging to the "Barn Owl" section, and strictly a vermin-killing species, and the two little hawk-owls, *Ninox Boobook* and *Ninox Maculata*, which are chiefly insect-feeding species. In Victoria all owls are strictly protected, and in South Australia and New South Wales I believe they are partly so. I would therefore suggest that a deputation from the Royal Society wait on the Premier and request him to take steps at the forthcoming session of Parliament to have our owls protected, shooting them being forbidden, except for scientific purposes, when specimens may be required to assist naturalists in any research they may be engaged in.

I may add that my friend, Dr. Agnew, is very anxious to see this step taken, and though I myself have long wished to see our owls protected, it is mainly at the Doctor's suggestion that I put the matter before the Society.

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*I was not aware, when I read this Paper, that the owls were protected by Act of Parliament, passed in 1887.—W.V.L.

PROTECTION OF THE CAPE BARREN GOOSE.

By Col. W. V. Legge, R.A.

There is another bird for the protection of which I would suggest steps be taken by this Society. It is the Cape Barren Goose (*Cereopsis Novæ Hollandiæ*), a bird of very limited distribution, which is only found to inhabit the Bass Straits Islands, and according to Gould, the adjacent shores of Victoria. I make the suggestion purely in the interests of science, and I am therefore aware that it will be all the more difficult to carry out the matter. This goose is one of the very interesting monotypic generic forms which exist among the *Anatidæ* in Australia, the others being the Semi-palmated goose, *Anseranas Melanoleucos*, the pink-eyed duck, *Malacorpynchus Membranaceus*, the musk duck, *Biziura Lobata*, and the freckled duck, *Stictonetta Nævosa*. There is but one species to each of these remarkable genera (all forms peculiar to the Australian region) and it would be a thousand pities to see any of these birds become extinct. In Gould's day he found that the Cape Barren Goose must become extinct owing to its tame disposition, terrestial mode of life, feeding on the lands near the shore to a great extent. So inert is it described to be that numbers can be knocked down with sticks. The probability is that in the present day its numbers are much fewer than 40 years ago, and it is therefore not an exaggerated view of the case to say, that there is danger of this species being shortly relegated to the category of the Dodo and the Great Auk, a contingency that would be viewed with deep regret by the ornithologists of the whole world. The Cape Barren Goose, it is true, can be easily domesticated, and it breeds in confinement, though apparently not continuously out of its native country. It formed part of a collection given by King William in 1830 to the London Zoological Society, and from 1835 to 1860 it bred 20 times, but after that until 1880 no instance of its breeding occurred. I think the best course to pursue would be to shorten the open season for it by three months and to alter the close season according to observations to be made in the Straits Islands at an early date, to the time best suited to its breeding.

I suggest the latter course, because, if it is desired to preserve our wild fowl to the best advantage, it will be necessary to alter the "open" season to suit the breeding habits of the various species better than it does at present. This can only be done after more careful observation of the breeding of our wild fowl than has been the case hitherto. Some naturalists might visit the Straits Islands, and after observations on the Cape Barren Goose and enquiry from the inhabitants of the island, smight afford us valuable information respecting it. At present the open season for it, though it inhabits a milder climate than other members of its family in this colony, is the same as the latter, and this cannot be correct. I trust other members of the Society will support me in my plea for this species, and that we shall be able to have something done towards the protection of this very interesting member of the great family of the *Anatidæ*.

A PRELIMINARY CRITIQUE OF THE *TERRA AUSTRALIS* LEGEND.

By James R. McClymont, M.A.

I. MISCONCEPTIONS DUE TO THE "NOVUS ORBIS."

In the Latin edition of the *Novus Orbis*, first published in 1532 in Basle and Paris, a letter from Lorenzo Cretico, Ambassador of the Venetian Republic to the court of Emanuel of Portugal, is translated from the *Paesi nouamente retrouati*, Vicenza, 1507, cap. cxxv. The letter treats of the Portuguese expedition to India, conducted by Cabral in 1500-1501, for although Cabral in not mentioned by name, we know that at the date of this letter (June 27, 1501,) his fleet had newly arrived in Lisbon, and was that to which the words of Cretico must apply when he spoke of the expedition "which the king sent most recently to India."

The letter begins with a brief itinerary of the voyage. They sailed along the African coast as far as Cape Verde, where they saw the Hesperides (Cape Verde Islands) and the coast of Lower Ethiopia, beyond which the ancients rarely travelled. From that point the coast trends eastwards until it reaches the meridian of Sicily; in latitude it is four or five degrees north of the equator; about the middle of it is the gold mine of this monarch (El Mina). A cape, called the Cape of Good Hope, rises further to the south, nine degrees south of the tropic of Capricorn. Thence the distance to our Barbaries is five thousand miles, coming towards our own shores. When you have passed that cape, the coast curves towards the promontory called Prasum, which the ancients, and chiefly Ptolemy, held to be the limit of the Southern Hemisphere; the land beyond he termed "Unknown." Thence their route was to the Troglodites and the gold mine called Sofala, where the ancients affirm that there is a greater quantity of gold than in any other place. Here they enter the Barbaric Gulf (from Mozambique to Mogadoxa), then the Indian Ocean, and finally reach the city of Calicut. Such was their route, which you will find to be almost fifteen thousand miles in length; but if you sail direct, it is less. Near the Cape of Good Hope they were driven by a south-west wind and discovered a new country, which they called the Land of Parrots—"Supra Caput bonæ spei lebegio vecti vento nacti sunt novam tellurem quam apellarunt

Psittacorum"—because they found these birds there in incredible number; some of them exceed a cubit and a half in length, and are of many colours; we have seen two, so that there is no doubt of the truth of it. When the sailors saw this coast, they believed it to be a continent, because they sailed for two thousand miles without coming to the end of it. Numerous naked and rather handsome men inhabit this country. *Novus Orbis*, cap. cxxv. *Exemplum literarum cuiusdam Cretici.*

This new land, discovered by Cabral, was, owing to the inaccuracy of the translator, located in a quite erroneous direction. If the ships were driven on it by a south-west wind, it must have lain to the east of their route, and it was placed by Mercator and other geographers west of the Cape of Good Hope and on a parallel somewhat south of it, and appears in Mercator's *Magna orbis terræ descriptio*; Duisberg, 1569, reproduced by Jomard, *Monuments de Géographie, No. XXI.*, under the name *Psittacorum Regio*, with an explanatory note to the effect that it was discovered by the Portuguese when on their way to Calicut they were driven upon it by a south-west wind. Where the *Novus Orbis* has "lebegio vecti vento," Mercator's map has "libegio vento appulsi." Cornelis de Jode says nothing about the direction of the wind, but simply that the *Psittacorum Regio*, which he places S.W. of the Cape of Good Hope, was so called by the Portuguese on account of the incredible size of these birds in that country, and on another map that the Portuguese in rounding the Cape have seen "this southern land" (the *Terra Australis*) extending opposite, but have not yet explored it—"*sed nondum imploravere.*" Cornelis de Jode.—*Speculum orbis terrarum.* Antwerp, 1593. The maps entitled *Orbis universalis descriptio*, 1589, and *Hemispherium ab æquinoctiali linea ad circulum poli antarctici.*

A blind adhesion to Mercator led subsequent cartographers to include this Land of Parrots in maps of various languages down to a comparatively recent date. M. d'Avezac mentions several of them. *Relation du Capitaine de Gonneville*, p. 20. note; p. 22, p. 22, note.

This Southern *Regio Psittacorum* had, however, a synonym in a quite different part of the world. Johann Schöner's globe of the year 1520 bears the inscription "*America vel Brasilia sive Papagalli Terra,*" placed between 10 deg. and 20 deg. S.; Petrus Apianus places in a similar position the legend "*Brasilici sive Paragalli.*" *Cogniti orbis tabula.* Ingolstadt, 1530. How comes it that lands so far apart as Brazil and the legendary *Terra Australis* should be brought into conjunction? The answer is to be found in comparing the letter of Cretico, as translated in the *Novus Orbis*, with the version in the *Paesi*, published twenty-five years earlier. We shall find that the cartographers were right or wrong in their location of the *Regio Psittacorum*, according as they took the one or the other of these texts for their guide.

The critical method of Kant has taught us moderns to place no faith in second-hand testimony, or in reasonings based upon plausible conjecture to which antiquity and authority have added a specious prestige. But in the days of the *Novus Orbis*, and even down to the confines of our own age, a conjectural theorising held the place which criticism now holds. The theory which taught the existence of an antipodal continent as necessary, in order to maintain the globe in a condition of counterpoise, is to be met with in a multitude of geographical treatises, in maps, and even, at a later period, in actual expeditions undertaken with the object of discovering the antipodal world—a striking instance of the influence of the philosophic upon the practical mind. When any fresh discovery was made, this favourite theory and the innate love of systematisation combined to induce geographers of the Ptolemaic school to identify the new land of fact with the old land of phantasy, and so a southern continent was pieced together out of the figments of men's brains and the inadequately recorded details of actual voyage. The compiler of the *Novus Orbis*, Jans Huttich, was, like his contemporaries, predisposed to adjust any fresh discoveries to the current misconceptions regarding the configuration of the globe and the distribution of land and water.

The *Paesi*, one of the first, if not actually the first collection of voyages compiled in modern times, was the work of Montalboddo Fracan, and was first published in Vicenza in 1507, and in Latin and German versions in 1508. The passage referring to the discovery of the *Regio Psittacorum* is thus worded in the Italian version :—"Di sopra dal capo d Bôasperâza uerso garbi hano scopto una terra noua la chiamâo d li Papaga." The words "uerso garbi" are those over which the translator has stumbled. They mean "towards the south-west." The German version has "gegê nidergâge auff d' seitê"—"towards the side of the west." The passage will run thus :—"Above the Cape of Good Hope they discovered a new land towards the south-west, which they called the Land of Parrots." With this indication of Cabral's landfall the above cited inscriptions of Schöner and Apianus agree, as well as the independent accounts given in Ramusio (i., 121), and in the letter of Emanuel to the Spanish sovereigns. (Navarrete, *Viages y descubrimientos* iii., 94.) Instead of lying to the east of the route to India the *Regio Psittacorum* actually lay to the west of it,—was in fact the Vera Cruz of Cabral, which appears on a map by Johan Ruysch in a Ptolemy published in Rome in 1508—"*Univer-*

salior cogniti orbis tabula"—under the name "*Terra sancte crucis sive Mundus novus,*" but which was known to French sailors as "Terre de Brésil."

II. MISCONCEPTIONS OF FRENCH CARTOGRAPHERS.

At the time of the publication of the *Novus Orbis* a French geographer and mathematician, named Oronce Finé, had just published, perhaps in Venice, a heart-shaped map of the world,—the second of its kind known to us. It was entitled, *Nova et integra universi orbis descriptio,* and dated 1531. This map was issued a second time in 1532 in the Paris edition of the *Novus Orbis.* It represents a *Terra Australis* brought up to about 25 deg. S. in longitude 210 deg. to 240 deg. E. from Ferro, and bearing the legend "*Terra Australis recenter inventa sed nondum plene cognita,*" a phrase of which the "*sed nondum imploravere*" of de Jode's map sounds like an echo. There is no *Regio Psittacorum* on Finé's map, but there is what we have seen to be its true equivalent, a *Regio Brasilie,* transferred, however, from its true American position to the legendary *Terra Australis* without further note or comment, and as if to clinch the error, a *Regio Patalis,* or *pratalis* as well, that is, the country of silver, of La Plata.

This obvious and hopeless confusion of places was further augmented in the MS. maps of other French cartographers. Jean Rotz, Guillaume le Testu, Nicholas Desliens, and others, mostly Norman pilots, represent a country which they denominate "Jave la Grande," midway between Africa and South America, and inscribe on it a number of names, some in French and some in Portuguese, and the figures of men and animals. That this Jave la Grande is only an imaginary place is admitted by one of the draughtsmen himself. In a MS. atlas, finished in 1555, and dedicated to Admiral de Coligny, who was then sending out a Huguenot colony to Brazil, are twelve maps numbered xxxi. to xliii., in which the space comprised between 1 deg. and 84 deg. S. is occupied by a fertile country. "But these twelve maps," says their author, Guillaume le Testu, of the town of Françoyse de Grâce, "are only meant to warn those who may voyage in these parts to be careful when they think they are approaching land. Further than that, all is imaginary, for no man has made any certain discovery there." (Margry, *Navigations françaises,* p. 138.) The title "Jave la Grande" on these charts is derived from the travels of Marco Polo, who designated Borneo under the name "Java," whilst the island known to us as Java was named by him "Java Minor." (*Marco Polo's Travels,* edited by W. Marsden. Book iii., chap. vii.) The coast lines and coast names are not, as Le Testu says, "all imaginary," for they are in part derived from the actual names and outlines of the South American coasts, with which, in some charts, the purely imaginary outlines of the *Terra Australis* of previous geographers are combined. Only the east coast of South America is inverted and so becomes the west coast of "Jave la Grande," whilst the east coast of "Jave la Grande," less salient in its physical features than the west coast, and therefore less easily identified, may be either inverted or simply transferred from the west coast of South America, or may be, as Le Testu says, "all imaginary." In some of these charts, as in the Dauphin map (about 1530), one of those of Jean Rotz (1542) and that of Desceliers (1550), the eastern coast-line ceases or becomes a vague featureless line at about 35 deg. S. The chart of Desliens (1566) prolongs that coast to about 65 deg. S., and gives to this prolongation features as specific as to the northern part of it.

By inverting the western coast line of "Jave la Grande" we find the following coincidences with the east coast of South America. Beginning from the north we have a "Grant Baye," and another unnamed inlet, probably representing the mouths of the Amazon and Tocantins. "R. Grande" in some of the charts forms a strait between "Jave la Grande" and an island named "Jave;" in that of Desliens it is a deep bay and unnamed. "Baye Bresille" in about 18 degrees S., may coincide with Porto Seguro, immediately to the south of which place, and in the same latitude as the "Baye Bresille," a "R. da Brasill" is marked on these charts. To the French sailors is due this name "Brazil," as the distinctive appellation of the country whence they brought brazil-wood to Europe. "The French alone," says La Popelinière, "called it 'Terre de Brésil,' in ignorance of what is above narrated,"—(namely, that Cabral had called it "Vera Cruz")—"because they found brazil-wood there in abundance, although it is only in one part of it, and that produces many other woods as well." *Les trois mondes*, iii. p. 16. verso. A number of names cluster round the vicinity of Cape Frio and Cape St. Thomé, such as C. Quiesco in Desliens, C. de Sr Drao, and C. de Grace in the Dauphin chart. The last is probably a Norman sailor's reminiscence of his native Havre de St. Francoyse de Grâce; the second may be mis-written for the name of some merchant adventurer—"sieur," in the language of the time. The next notable feature is the Havre de Sylla, between 25 deg. and 30 deg. S., apparently intended for Rio de Janiero. Desliens marks a Golfe des Ysles in from 40 deg. to 45 deg. S., resembling the Gulf of St. Mathias. If we so understand it, and if Havre de Sylla represents Rio de Janiero, then the River Plate has been omitted. A parallel to this would be found in the voyage of Diaz de Solis, who sailed along these coasts from

Cape St. Augustine to 40 deg. S., without observing the mouth of that river. The coast-line of Desliens is prolonged about 10 deg. south of the actual termination of the American continent. This excessive southing is characteristic of maps of that period and of that continent. Thus Schöner in his globe (1520) places Bahia 10 deg. or more to the south of its true position.

The intercourse of Norman merchants with Brazilian ports very early in the sixteenth century, gives us to understand how the outlines of that part of the American coast should have become known in Normandy; and the fact of the extreme ignorance of longitude, and how to ascertain it that prevailed at the period we are speaking of, combined with the confusion already existing in the minds of cartographers between Brazil and the *Terra Australis*, all this explains to us, in a great measure, how the South American coast-lines came to be transferred to so distant a part of the world. It can, however, only be matter for conjecture why Rotz and the others made an eastern coast into a western one. We only know that it was the western part of the *Terra Australis* that the Portuguese were supposed to have discovered, whilst it was, in all probability, the eastern coast of South America that was first and best known to the French.

The advent of French ships in Brazil about the time of Cabral's visit, or earlier, is well attested. Ramusio preserves a memoir written in 1539, in which we are told that "a portion of Brazil was first discovered by the Portuguese; and thirty-five years ago Denys de Honfleur discovered the other part." iii. 357, F. The results of an inquiry into the date of the first French traffic with Brazil were published in 1845, in the *Revista trimensal do Instituto do Brazil*, vi. pp. 412-413. "In the year 1504," says this journal, "the French arrived in Brazil for the first time at the Port of Bahia; they entered the River Paraguaçu, in that Bay, did their traffic there and, when they had done a good trade, returned to France, whence three other ships came afterwards. Whilst these ships were trading at the same place as the former ones, four ships of the Portuguese fleet entered the river and burnt two French ships; and took the third, after killing a number of their people. Some of them, however, escaped in a boat and found at Point Itapuama, four leagues from Bahia, a French vessel about to return home." The *Revista* is at fault in assigning to the year 1504 the earliest appearance of the French in Brazil. I do not require at this stage to ask where was the much disputed landfall of De Gonneville, but only to quote some remarks of his regarding the country at which he touched to freight his vessel on his way home from the "Indes Meridionales" of his six months' sojourn. "Then having passed the tropic of Capricorn and taken our position, we found that we were furthur from Africa than from the West Indies, where for several years the Dieppese and Maloinese, and other Normans and Bretons have gone to fetch red dye-wood, cottons, apes, parrots, and other commodities; as the east wind, which we observed to prevail between the said tropic, and that of Cancer impelled us thither, it was unanimously agreed to go in search of that country, in order to load with the above-mentioned articles of merchandise, so as to recoup ourselves for the expenses of the voyage; and we arrived there on the day of St. Denis (October 10, 1504), as aforesaid." *Voyage du Capitaine de Gonneville*, par. M. d'Avezac, Paris, 1869, p. 104. This mention in the year 1505 of the West Indies,—the name by which South America was generally known,—as a resort since some years of French ships throws back their advent in that country to the end of the fifteenth or beginning of the sixteenth century. La Popelinière states—"The French, especially the Normans and Bretons, always maintain that they first discovered these lands and traded with the savages of Brazil, on the Rio San Francisco, at the place since called Port Réal. But thoughtless in this, as in other things, they had neither spirit nor discretion to leave a single public document to inform us of their designs, which were as lofty and generous as those of other people; thus it is that the Portuguese arrogate to themselves the prerogative of indisputable lordship there, in consequence of the action of Pedro Alvares." *Les trois mondes*, iii. p. 16 verso.

The illustrations of the native life of "Jave la Grande" are referable to South America. The llama—the sheep strong enough to carry a man as one old geographer describes it,—is frequently depicted. In one chart (Dauphin) it is harnessed and being driven along. The cannibalistic practices of some of the tribes are signified by Desceliers, by a drawing of a dog-faced man engaged under the direction of a woman in quartering a dead body, whilst a human limb hangs suspended from a neighbouring tree. This reminds one of Vespucci's account of the fate of a young Portuguese of his third expedition, and of the human flesh which he saw exposed in the villages. In the same map of Desceliers, under the heading "Angania," the inhabitants of that country are described as dog-faced Anthropophagi. The huts of the aborigines of Jave la Grande are in the Dauphin map identical with those of the South Americans, being roofed with palmate leaves, but they are without the hammocks of the latter, which were characteristic of the tribes inhabiting the north of Brazil. Desceliers has drawn clusters of anthill-shaped structures on his Jave la Grande, and on the West Coast of his South America. On Jave la Grande he has pictured the worship of the Sun, common to Peru and some other countries, as well as the worship of cattle, both of which cults are ascribed by him to the Javanese.

The deer, of which numerous small species exist in South America, and the peccary *Dycotyles torquatus* and *labiatus*, are both pourtrayed. Perhaps both, certainly the latter, is represented as tame; the Indians of to-day keep it as a domestic animal. (Humboldt's *Travels in America,* ii. chap., xx.) Two species, at least, of palms are represented, one with palmate and the other with pinnate leaves; a tree of the former species, the *Corypha tectorum,* or roofing palm, is described by Humboldt as affording the Chaymas Indians the leaves with which they roof their huts. (i. chap. xx.)

The existence in France of a MS. chart as early as 1530, which shows the east coast of South America to about 25 deg. S., and which is derived from French sources, is thus no matter of wonderment. But the possible acquaintance on the part of the French with the western coast of South America, even at that date, is a matter on which we can as yet throw but little light. In these circumstances a passage quoted by M. Margry from the MS. *Cosmographie* of Jean Alfonce (1545), is not without interest. "La Grande Jave" says the writer, "is a land which extends to the Antarctic Pole and joins the Terra Australis on the west and the land of Magellan's Straits on the east. Some say that it consists of islands, but as far as I have seen it, it is a continent, and when all is said, the whole world consists of islands, for land and water form one body. The ocean encircles everything by means of arms of the sea, which are in the ball (pomme) of the earth. What is called Java Minor is an island; but Jave la Grande is a continent." In another place Alfonce remarks:—"There have been no discoveries beyond Java on account of the great cold under the Antarctic Pole. I have been in a place there where day lasted for three months, allowing for the reflection of the sun; I did not wish to remain longer in case night should surprise me." Margry, *Navigations francaises*, pp. 316-317. The only continental land to which this description can approximately apply is the west coast of South America. That coast joins the land of Magellan's Straits towards the east, and although there is no *Terra Australis* of fact with which it can be joined towards the west, there was a *Terra Australis* of fiction real enough to Jean Alfonce in the position required. At another part of his *Cosmographie,* Alfonce brings his "Grand Jaive" up to 21 deg. S., or about the latitude to which Desliens traces the eastern coast of "Jave la Grande."

Besides the French names on the MS. charts, of which I have spoken, there are others in Portuguese. The latter generally differ from the former, inasmuch as they are rather nautical than topographical, and correspond to the phrases printed on the Admiralty Charts for the purpose of directing masters of ships where they are to look out for shoals, eddies, or other dangers. Thus we find *terre ennegada*, or *anegada*,—sunken shoal—and *baixa*,—shoal. This introduction of Portuguese nautical expressions is an indication of the superior skill of the Portuguese pilots of the time, which has left traces in the adoption of their language by foreigners,—as in the word *abrolhos*, breakers,—just as in our own day English nautical terms have been adopted in continental navies. But we know that the intercourse between Portuguese and French, as well as Spanish and French sailors, was from the fourteenth century onwards a peculiarly intimate one. Commercial privileges with French ports were accorded to both these nations. (Margry, p. 123 note.) On the other hand the vessels of Honfleur merchants had access to the port of Lisbon, and in 1503 three of these merchants, De Gonneville, Jean l'Anglois, and Pierre le Carpentier, having seen at Lisbon the rareties that had lately arrived from the East in the ships of Vasco da Gama and Cabral, engaged the services of two Portuguese pilots who had been to Calicut, Bastiam Moura and Diego Cohinto, in order that they might despatch a ship of their own to the same destination. The two Portuguese accompanied the ship in its wanderings about the Atlantic; and touched at several points of the South American continent. Barros relates that a vessel from Dieppe, commanded by a Portuguese captain, Stevam Diaz, arrived at Diu in July 1527, and that in the same year another French ship, piloted by another Portuguese sailor, called "O. Rozado" or "The Rosy," was in the Indian seas and was ultimately lost on the west coast of Sumatra. (Margry, p. 192.) Similarly, French sailors sailed in Spanish and Portuguese vessels, and Navarrete preserves the names of twelve French companions of Magellan, the half of whom were Normans or Bretons. *Viages*, iv. 12.

III. MISCONCEPTIONS ARISING FROM THE VOYAGE OF MAGELLAN.

A claim to the discovery of the *Terra Australis* has been recorded on behalf of Magellan in an atlas by Fernando Vaz Dourado, Goa, 1570, in which a coast lying to the east of New Guinea, and trending east and west with a little southing, bears the superscription "Esta costa descubrió Fernaô de Magalhâes naturall portuges por mandado do emperador Carllos o anno 1520." This claim occurs also on maps by Rumoldus Mercator (1587), Ortelius (1587), and De Jode (1589), in the words,—placed on a northward projection of the *Terra Australis* immediately to the south of New Guinea:—"Hanc continentem australem nonulli Magellanicâ regionem ab inventore eius nùncupant."

From the facts that the coast-line so described is in the map of Dourado disconnected by an intervening scale of latitude from the rest of the map, and that it bears some of the same names as were bestowed by Magellan on places visited by him in South America, Mr. Major supposes that it is "a memorandum or cartographical side-note of the real discovery by Magellan of Terra del Fuego." *Terra Australis*, p. xxvi. The position of this coast on Dourado's map may have led to its being confounded with the north coast of New Guinea by Mercator, who adopts some of Dourado's coast names; but transfers them to the above-mentioned island. Amongst these are C. de las Virgenes, and C. del buen Deseo equivalent to Cabo Deseado, Magellan's names for the capes at the entrance and exit of the Straits. Some of the names used on the coasts of Jave la Grande much resemble others in the atlas of Dourado, and on a map by De Jode, entitled *Brasilia et Peruvia*, but they are placed by these cartographers in or near the Straits of Magellan. Such are Baia Fremosa in Dourado and De Jode, corresponding to C. Fromose in the Dauphin map, and in De Jode, C. Blanco corresponding to Coste Bracq, C. de las Baixas to Baye Bassa, B. d muchas islas to R. de Beaucoup Disles, and Costa dos Ilheos to Baye des Ys. This parallelism is suggestive of a community of origin, and raises the question whether the voyage of Magellan may not in some degree have contributed to originate the MS. charts of Jave la Grande.

It has been recently upheld by Mr. Petherick that Del Cano on his return voyage in 1522, sighted some part of the west Australian coast. (*Athenæum*, May 24, 1884.) This opinion is based on a passage in Galvano's *Discoveries of the World*, to the effect that that navigator discovered certain islands one hundred leagues beyond Timor and under the tropic of Capricorn, and further on others, all peopled thenceforward, when he was shaping a course which should carry him well south of the Cape of Good Hope. It is not impossible that in a zig-zag course Del Cano may have sighted some islands very near the Australian mainland.

MACQUARIE HARBOUR LEAF BEDS.

By R. M. Johnston, F.L.S.

In the Tasmanian Museum there is a most valuable collection of fossil leaves belonging to the earlier tertiary period of Tasmania, but in respect of which there is no record as to the locality from which they were originally obtained. I was long of opinion that this peculiar group of fossil plants was obtained by Dr. Milligan from Macquarie Harbour in the early days of the colony's history, and this conviction was one of the main reasons which induced me to visit and examine the leaf deposits of Macquarie Harbour in the year 1887. In this examination I was unsuccessful in discovering the exact deposit from which the Museum collection was obtained, but the discovery of the same forms in the lacustrine beds in the neighbourhood of Long Bay tended to confirm me in the notion that the unknown deposit was a member of the lacustrine leaf beds extending from the latter locality to Kelly's Basin; and in my work on geology (p. 203, "Geology of Tasmania"), I ventured to predict that an examination of the many fine sections further east "may in the future determine this matter." I am happy now to be in the position to declare that the hitherto unknown locality has been discovered; for in a fine collection of fossils made by that indefatigable member of our society, Mr. T. B. Moore, and sent last year to Mr. Belstead, I was fortunate in recognising the identical rock, together with the usual impressions of leaf forms, so characteristic of the museum collection referred to. I now present a specimen of the rock in question, in order that those interested may be able to judge of its value in clearing up this interesting point in our tertiary geology. On a future occasion I may be able to give a description of the more remarkable plants contained in this deposit.

FORAMINIFERA IN UPPER PALÆOZOIC ROCKS.

By T. Stephens, F.G.S., M.A.

At former meetings of the Royal Society I have incidentally mentioned a foraminiferal limestone as occurring among the Upper Palæozoic rocks of the North-Eastern district. Several years ago on one of my official cross-country journeys I met with specimens of limestone dotted with minute white spots, and on closer examination detected two or three more or less perfect forms of *Foraminifera*, one of them resembling genus *Spirillina (Trochammina,)* and another like *Valvulina.* In the absence of any local palæontologist competent to determine the specific character of these fossils, and having myself to attend to other business, I had put the specimens away until a few months ago, when I had an opportunity of submitting them to Mr. R. Etheridge, jun., who is engaged in working out the palæontology of New South Wales, and the following is an extract from a letter lately received by him:—"I have at last had time to examine the pieces of supposed *foraminiferal* rock you left with me. There is no doubt but that is their nature, and, so far as I know, it is the first record of such in the Permo-Carboniferous rocks of Australia or Tasmania. I have sent the material to a *foraminifera* man, so we shall hear more about it soon." The difficulty of separating these small fossils from the matrix is very great, but I have roughly mounted a few for inspection.

AUSTRALIAN AND TASMANIAN SANDARACH.

By J. H. Maiden, F.L.S., F.C.S., Etc. (Curator of the Technological Museum, Sydney).

Communicated by A. Morton, F.L.S.

It was a specimen of resin from the Oyster Bay Pine of Tasmania, sent to the Exhibition of 1851, which first drew the attention of experts to the possibilities of Australian Sandarach. For "the fine pale resin of the Oyster Bay Pine (*Callitris australis*), from the eastern coast of Van Diemen's Land," and other gums and resins, Mr. J. Milligan was awarded honourable mention (Jury Reports, 1851 Exhibition, p. 182).

This is one of the most valuable of Australian* vegetable products, a market is ready for it, and it seems strange that it should have been so long neglected. There are no statistics available in regard to the importation of Sandarach into these colonies, but to bring it here at all is a veritable "carrying coals to Newcastle."

Ordinary Sandarach exudes naturally, but the practice in Northern Africa is to stimulate the flow, making incisions in the stem, particularly near the base. In various parts of Australia and Tasmania there are vast numbers of *Callitris* trees, their resin, often abundant, can readily be collected, and the author is sure that, even with the cheap labour of Northern Africa to contend against, it can be profitably gathered during a portion of the year, by parties of men, or the families of settlers. The approximate price of Sandarach, in London, is 60-115s. per cwt., and there is no difference between it and the colonial article. As to the cultivation of the trees, Baron von Mueller (*Select extra-tropical plants*, Victorian Edition) states, "Probably it would be more profitable to devote sandy desert land, which could not be brought under irrigation, to the culture of the Sandarach cypresses, than to pastoral purposes, but boring beetles must be kept off." It is also to be borne in mind that *Callitris* timber is valuable.

The Sandarach, or Gum Juniper of commerce, is the product of a *Callitris* (*quadrivalvis*), and the latest classification of Australian Sandarach trees (that of Baron von Mueller), places them under *Callitris* likewise. The following summary of the uses of Sandarach, is taken from Morel (*Pharm. Journ.*

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* This word is here used in its widest sense, and, of course, includes Tasmania.

[3]. viii. 1,024.) "According to Gubler, the Arabs used it as a remedy against diarrhœa, and to lull pain in hæmorrhoids. The Chinese employed it (*C. sinensis*) as a stimulant in the treatment of ulcers (as promoting the growth of flesh), as a deodoriser, and to preserve clothes from the attacks of insects. In Europe it is used very little in medicine. It is most frequently employed as an ingredient in varnish, to increase its hardness and glossiness. It is used also as a fumigant, and in powder ("pounce") to dust over paper from which the surface has been scraped, to prevent the ink running. Rarely, it enters into the composition of plasters." In Southern New South Wales (Snowy River), *Callitris* resin is often mixed with fat by the settlers, to make candles.

All our native Sandarachs possess a pleasant aromatic odour, similar in character to that emitted by Sandarach.

When the trees are wounded the resin exudes in an almost colourless, transparent condition. It has obviously high refractive power, and is much like ordinary pine resin in taste, smell, and outward appearance, when the latter is freshly exuding. This transparent appearance is preserved for a considerable time, the resin meantime darkening a little with age. Old samples possess a mealy appearance, but this is merely superficial. The origin of this appearance has been explained as follows in regard to Sandarach, and doubtless the simple explanation holds good here :—

"The surface of the tears appears to be covered, more or less, with powder, but this character is not to be attributed, as alleged by Herlant, (*Etude sur les produits résineux de la famille des conifères*, p. 38), to the friction of the fragments one against another, but, as has been ascertained by a microscopical examination by Dr. Julius Wiesner (Die chemisch-technisch verwendte Gummiarten, Harze and Balsame, 1869, p. 129), to the unequal contraction of the resin while drying, resulting in a mass of fissures that form, as in the case of several kinds of copal, facets that gradually separate from the mass, and constitute the "powder" of many authors." (Morel, *op. cit.*) Evidence against Herlant's supposition is also found in the fact that resins of the Sandarach class are mealy *while on the trees*, after they have been exuded some little time, showing that the appearance is brought about by exposure to the weather.

The *Callitris* resins soften slightly, but do not melt in boiling water, and a sample of commercial Sandarach behaves similarly. In the mouth they feel gritty to the teeth, and in no way different to Sandarach. When freshly exuded they are very irritating to a cut.

Following are descriptions of actual specimens of resins of different species. For the results of analyses of Sandarach for comparison, see *Gmelin*, xvii., 429.

CALLITRIS CUPRESSIFORMIS. *Vent.*

Muell., Cens. p. 109. Syn. *C. australis* (ined.). ***Frenela rhomboidea*** Endl. Var. *Tasmanica*, Benth. *F. Ventenatii* Mirb., B. Fl., vi., 238, and others.

"The Oyster Bay Pine of Tasmania." Found in all the colonies except Western Australia (normal species).

This is the pine already referred to, and a brief account of the resin has been copied into many of the text-books. I have collected resin of this species from Port Jackson, clear and transparent as water. It turns pale amber coloured in 12 months if placed in a bottle, but its brilliancy shows no sign of diminution in that time. The Sydney trees readily exude their resin on slightly wounding, and the same remarks apply to the Tasmanian.

CALLITRIS CALCARATA. *R. Br.*

Syn. *Frenela Endlicheri* Parlat., B. Fl., vi., 238.

Found from Northern Victoria to Central Queensland. "Murray Pine," "Black Pine," Red Pine," "Scrub Pine," "Cypress Pine."

Sample 1. "Murray Pine," Quiedong, 3rd March, 1887. Has a pale, bleached appearance, much lighter than ordinary Sandarach. Externally it has a very mealy appearance. Water has no effect on it. In rectified spirit it almost wholly dissolves, leaving a little whitish, resinoid substance. Petroleum spirit dissolves 5 per cent. of a perfectly colourless and transparent resin.

Sample 2. I have received a quantity of flesh-coloured resin from the Snowy River, N.S.W., belonging to this species. It is so different in appearance from the normal resin, that no market can at present be found for it, and as this is the first time such resin, in quantity, has come under my notice, it is well worth describing. It is of the consistence and general appearance of Manila elemi, differing from that substance in being of a flesh-colour, and having a pure turpentine odour, instead of a turpentine-fennel one.

There is no doubt that it would form a valuable ingredient in plasters, and an enterprising pharmacist would doubtless find it worth his while to follow the matter up.

It is a remarkable circumstance that the trees yielding this resin had also, at other portions of the stem, more or less of the normal Sandarach.

Sample 3. "Red Pine." Lachlan River, N.S.W. Feb. 1885. This has comparatively freshly exuded, and has the colour and appearance of the best selected Sandarach.

Rectified spirit nearly wholly dissolves it, forming a beautifully clear, slightly yellowish liquid; 1·3 per cent. of residue remains. Petroleum spirit extracts 22·1 per cent. of an apparently perfectly colourless and transparent resin.

CALLITRIS COLUMELLARIS. *F. v. M.*

Syn. *Frenela robusta* A. Cunn., var. *microcarpa* Benth. B. Fl. vi. 237.

Sample 4. "Cypress Pine," etc. Found in New South Wales and Queensland. Received from the Botanic Gardens, Sydney, Dec. 1887.

This is in much larger masses than the others, and some of it has been exuded for a considerable time. It is next lightest in colour to No. 1.

It almost wholly dissolves in rectified spirit, forming a pale yellow solution. The insoluble residue amounts to 4·6 per cent. Petroleum spirit, when digested on the residue, removes no less than 35·8 per cent. of a transparent colourless resin. This is a remarkable percentage, and it would be worth while to enquire whether Australian Sandarach becomes increasingly soluble in that menstruum by age. An ordinary sample of commercial Sandarach yielded 8·9 per cent. to petroleum spirit.

CALLITRIS VERRUCOSA. *R. Br.*

Syn. *Callitris Preissii* Miq. *Frenela robusta* A. Cunn. and others. B. Fl. vi. 236.

The following note by Dr. Julius Morel (Pharm. Journ. [3] viii. 1,025), in regard to a South Australian specimen, is interesting! "With Sandarach resin may be connected another resinous substance, which was exhibited in the Paris Exhibition of 1867 from South Australia, under the name of "pine gum." It is the resin of *Callitris Reissii* Miq. (a misprint for *Preissii*). This product resembles Sandarach, and might become an important article of commerce. . . . This resinous substance occurs in the form of slightly yellowish tears, thicker and longer than those of ordinary Sandarach. In consequence of unequal contraction, it presents, like Sandarach, numerous facets, and consequently the surface appears to be covered with a white powder. By examining this resin under the microscope, Wiesner ascertained that the finer fissures were derived from the larger ones. In its transparency and hardness the resin corresponds to Sandarach. Its odour is very agreeable and balsamic, and its taste is bitter and aromatic."

"Mountain Cypress Pine," "Desert Pine." "A Sandarach in larger tears than ordinary Sandarach is yielded by this species. It yields it in considerable abundance, eight or ten ounces being frequently found at the foot of a single tree, but although this exudes naturally, the supply is stimulated by incisions." *Victorian Cat.* Col. and Ind. Exhib., 1886.)

"It is a transparent, colourless, or pale yellow body, fragrant and friable, fusing at a moderate temperature, and burning with a large, smoky flame, very soluble in alcohol and the essential oils, and almost totally so in ether; turpentine at the ordinary temperature does not act upon it, nor do the drying oils, but it may be made to combine with these solvents by previous fusion." (*Report on Indigenous Veget. Subst. Victorian Exh.*, 1861).

Sample 5. Obtained from the Botanical Gardens, Sydney, 29th December, 1887; no particulars available.

Of a dark amber colour, and externally possessing the dulled appearance found with lumps of amber. It is the darkest resin examined by me.

It almost wholly dissolves in rectified spirit, yielding a bright yellow liquid, leaving 2·5 per cent. of insoluble residue. Petroleum spirit removes 22·8 per cent. of a clear resin when the original substance is digested in it.

DISCUSSION.

MR. STEPHENS remarked how unfortunate it was that people in the colony were so little alive to their own interest. The Oyster Bay Pine was useful for a variety of purposes, being suitable for light hurdles, gates, and other uses for which the common hardwood timber was ill adapted, while the advantage gained from shelter to stock was far superior to any that could result from its wholesale destruction. This beautiful and useful tree had, however, been destroyed, so far as it could be destroyed, by ring-barking over thousands of acres on the East Coast.

The **PRESIDENT** stated that he had had his attention directed to the state of things mentioned by Mr. Stephens.

NOTES ON THE LAST LIVING ABORIGINAL OF TASMANIA.

By James Barnard, V. P.

It has been generally supposed that the grave has closed over the remains of the last of the aborigines, and that the extinction of the race has been final and complete. This supposition, however, is believed to be erroneous ; for there still exists one female descendant of the former "princes of wastes and lords of deserts" in the person of Fanny Cochrane Smith, of Port Cygnet, and the mother of a large family of six sons and five daughters, all of whom are living.

Some doubts have been cast in Parliament and elsewhere upon the claim of Fanny (to keep to her pre-nuptial and first Christian name) to be of the pure blood of her personal ancestors, but after searching the records, and upon her own testimony, and from other evidence, there seems to be little reason to doubt the fact.

It appears, then, that Fanny was born at Flinders Island in 1834 or 1835, and is now about 55 years of age. Sarah was the name of her mother, and Eugene that of her father, and both were undeniably aboriginals. Sarah first lived with a sealer, and became the mother of four half-caste children; and was subsequently married to Eugene (native name, Nicomanie), one of her own people, and had three children, of whom Fanny is the sole survivor and representative of the race.

Lieut. Matthew Curling Friend, R.N., in a paper read before the Tasmanian Society, on March 10th, 1847, "On the decrease of the Aborigines of Tasmania," in alluding to the curious theory propounded by Count Strzelecki, that the aboriginal mother of a half-caste can never produce a black child should she subsequently marry one of her own race, controverts this notion of invariable sterility by quoting two instances which came under his notice while visiting the aboriginal establishment at Flinders Island. I give his own words:—"One was the case of a black woman named Sarah, who had formerly four half-caste children by a sealer with whom she lived, and has had since her abode at Flinders Island, where she married a man of her own race, three black children, two of whom are still alive. The other, a black woman named Harriet, who had formerly by a white man with whom she lived two half-caste children, and has had since her marriage with a black man a fine healthy black infant, who is still living."

Commenting upon this doctrine of Strzelecki, West observes (Hist. of Tasmania, vol. 2, p. 75), "A natural law by which the extinction of a race is predicted will not admit of such serious deviations."

Some explanation may properly be expected from me for reviving a question which was supposed to be set at rest when Truganini was consigned to the tomb, and declared to be the last woman of her race. I will therefore mention the incident which has given me something of a personal interest in the matter. It is now nearly 40 years ago that I was accustomed occasionally to accompany my friend the late Dr. Milligan, the Medical Superintendent of the Aborigines, to the settlement at Oyster Cove, where I saw a good deal of the native people, at that time some 30 or 40 in number. Among these I have a distinct recollection of Fanny, who was then apparently about 17 years of age, slender and active, less dusky in colour, but rather more prepossessing in appearance than any of her kind; and certainly at that time I never heard a doubt expressed of her not being a true aboriginal. There was one circumstance in particular which impressed her upon my remembrance, and that was on one occasion we crossed over in a boat from Oyster Cove to Bruni Island, rowed by four of the black men, and Fanny taking the steer-oar, which she handled with marvellous skill and dexterity. My visits to the settlement shortly after ceased, and from that time to the present, until a few weeks ago, when I was greatly surprised to receive a visit from this identical Fanny, who had become transformed into a buxom matron of considerable amplitude.

By the courtesy of the Hon. P. O. Fysh, Chief Secretary and Premier, I have been permitted access to the official records bearing upon the subject of this investigation.

The first documents brought under my attention were two letters under date June 23 and 26, 1882, embodying a report from the Police Magistrate of Franklin, the late E. A. Walpole, emphatically stating that Fanny "is a half-caste, born of an aboriginal woman, by a white man whose name is unknown, at Flinders Island, in or about the year 1835." No authority beyond the expression of his individual opinion is adduced by Mr. Walpole in support of his statement.

The next document was a letter by the late Dr. Milligan, Medical Superintendent of Aborigines, under date July 17, 1854, enclosing William Smith's consent to marry Fanny Cochrane, and describing her as an aboriginal girl belonging to the establishment at Oyster Cove. This affords strong evidence in support of the opposite view of the case, as those who knew Dr. Milligan would remember how precise and accurate he invariably was in any statement of facts.

A point of some importance in the contention would arise from Fanny's second name of Cochrane. According to Bonwick, in his "Last of the Tasmanians," p. 282, this was taken from the sealer who lived with Sarah, whose name was Cottrel Cochrane. Were this so, it would have at once have gone far to settle the question of parentage, and show her to be the half-caste supposed. Bonwick is obviously in error in his statement; for I have lately ascertained from the lips of a married lady living in Hobart, a daughter of the late Mr. Robert Clark, catechist at the aborigines establishment, that Cochrane was the maiden name of her mother, and that it was given by her father to Fanny when a child, and residing in his family.

Again, Bonwick writes (p. 310): "We read of a sawyer, one Smith, and his black friend, Mrs. Fanny Cochrane Smith, receiving £25 a year for their half-caste child." Instead of "black friend" he might have written "black wife"; for the parties were duly married at Hobart by the Rev. Frederick Miller, Congregational minister, in 1854. As respects the cause assigned for the annuity, this writer was also in error, for the sum of £24 (not £25) was bestowed upon Fanny on the occasion of her marriage, and not for the reason stated.

The next document is a letter, dated 8th December, 1842, conveying the official approval of the admission into the Queen's Orphan School of the three aboriginal children named in the margin—Fanny, Martha, Jesse.

Then follows in the records, under same date, an application from Mr. Robert Clark, late catechist of the aborigines on Flinders Island, for permission to receive into his family "an aboriginal child named Fanny, upon his engagement to feed, clothe, and educate her as one of his own children."

Next is an extract from an official document dated 8th March, 1847:—"Eugene and his wife, the father and mother of Fanny and Adam, being asked if they were willing that their children should be sent back to Mr. Clark, said they were not. Fanny being asked if she understood the nature of an oath, answered, 'No,' and the Doctor explained it. Fanny said she did not wish to return to Mr. Clark."

From a long report to the Government by Dr. Milligan, dated November 29th, 1847, I have taken the following extract:—"The fifth girl, Fanny Cochrane, almost a woman, might remain with her half-sister, Mary Ann. Indeed I can scarcely say how otherwise she could be satisfactorily disposed of." There being no difference of opinion as to Sarah being the mother of both, this testimony, given by Dr. Milligan as to a difference of parentage in the case of the father, at once discriminates her from Mary Ann, and in itself affords a strong presumption in favour of the contention.

The superintendent at Oyster Cove, under date 4th November, 1857, reports to the Colonial Secretary the death of Adam, aged 20 years, the youngest of the aboriginals; and states that during his illness he was waited upon by his mother, sister, and the latter's husband; these being respectively Sarah, Fanny, and William Smith.

Up to this point my researches have been eminently satisfactory, and have tended to confirm the theory of Fanny being an aboriginal; but another document has been brought under my notice which, unexplained, certainly discountenances that theory. It is the report of certain proceedings taken before Dr. Jeanneret, the superintendent at Flinders Island, on the occasion of certain allegations made against an officer of the establishment, and in which is a deposition made by Fanny, dated March 25th, 1847, commencing with these words,—"I am a half-caste of Van Diemen's Land. My mother is a native. I am about 13 years of age," etc., with her signature attached at the foot. At first sight this admission would appear to be conclusive and unanswerable; but, upon reflection, I am led to believe that there must be a mistake somewhere. In the first place a child of her age, with imperfectly developed intelligence, would scarcely be likely to volunteer that statement, or do more than give a mechanical assent to the question when asked, without, perhaps, at all understanding its import. Again, possibly the clerk writing the deposition may have understood that Fanny was sister to Mary Ann instead of *half*-sister, and naturally assumed them to be the offspring of the same parents. Besides, it conflicts with all the official correspondence in which she is referred to with Dr. Milligan, the medical superintendent, and Mr. Clark, the catechist, in all of which the term "half-caste" never once appears, and she is invariably designated an aboriginal girl, and distinguished from Mary Ann, her half-sister, and an undisputed half-caste. I may add, also, that Fanny wholly repudiates all knowledge or recollection of the evidence referred to. The paper of Lieut. Friend, which I have quoted, in which he refers to Sarah, the mother of Fanny, in support of his hypothesis, as well as the official statement given of Eugene being her father and Adam being her brother, should remove all doubt as to Fanny being a true aboriginal. While it is not to be denied that differences of opinion exist on the point, I think it must be allowed, from the facts brought forward, that the weight of testimony is in its favour.

The characteristics of the complexion and of the hair have been cited as favouring the opinion that Fanny must be deposed from the pedestal claimed for her as a pure aboriginal and placed in the ranks of the half-castes. Mr. Walpole states that "her colour is a very dark brown," but I should rather term it a blackish-brown, and showing the true aboriginal tint. On this point it must be remembered that from her infancy she has been encircled within the pale of civilised life, and shielded from the severities of weather and privations to which otherwise she would have been exposed,—all this, together with her surroundings, must naturally have, in some degree, tended to exercise a modifying influence. The same as to her hair, which, if less woolly and like a mop, has no doubt been combed and brushed out to some small extent of its original fluffiness to reconcile it to the model of the hair of the white children with whom she was brought up, and which she would naturally strive to imitate.

The question at issue may appear, at first sight, to be a mere personal matter, and of comparative unimportance, but it is in reality much more than that, and has acquired a scientific aspect deserving of attention. There is reason to believe that the theory of Strzelecki has influenced many to concurrence in his views, and to disregard or overlook the cogency of facts opposed to it. Lieut. Friend, as we have seen, disputes the dictum referred to, and has adduced strong evidence in support of his objection. Thus an interesting problem has been presented for solution.

All controversy, however, must now be regarded as finally set at rest, since the adoption by Parliament, after due inquiry, of two resolutions passed, respectively, in Sessions 1882 and 1884, by the first of which the pension of Fanny Smith was increased from £24 to £50 per annum, and by the second that a grant deed of the 100 acres of land she at that time occupied, and for the 200 acres additional then presented to her, should be issued to Fanny, free of cost; both votes being passed on the ground specified of her being the last survivor of the aboriginal race.

DISCUSSION

MR. STEPHENS asked the writer of the paper not to press the matter too strongly on the Society. While Parliament was free to act at its discretion in entertaining a claim, the Royal Society would not be justified in showing any amiable weakness in the same direction. If, however, he threw out a challenge to ethnologists, he ran the risk of depriving Fanny Smith of what she now enjoyed. He was certain the paper would be well received, and the writer must not attribute any failure to discuss it on its merits to any lack of appreciation.

THE ENGLISH AT THE DERWENT, AND THE RISDON SETTLEMENT.

BY JAMES BACKHOUSE WALKER.

Read October 14th, 1889.

1. The English at the Derwent.

In a paper which I had the honour to read before the Royal Society last November, entitled "The French in Van Diemen's Land," I endeavoured to show how the discoveries of the French at the Derwent, and their supposed design of occupation, influenced Governor King's mind, and led him to despatch the first English colony to these shores. That paper brought the story to the 12th September, 1803, when the *Albion* whaler, with Governor Bowen on board, cast anchor in Risdon Cove, five days after the *Lady Nelson*, which had brought the rest of his small establishment.

The choice of such an unsuitable place as Risdon for the site of the first settlement has always been something of a puzzle; and, in order to understand the circumstances which led to this ill-advised selection, it will be necessary to go back some years, and follow the history of English discovery and exploration in the South of Tasmania.

I have already noticed the elaborate and complete surveys of the Canal D'Entrecasteaux, and the Rivière du Nord, made by the French navigators in 1792, and again in 1802; but it must be remembered that the results of these expeditions were long kept a profound secret, not only from the English, but from the world in general. Contemporaneously with the French, English navigators had been making independent discoveries and surveys in Southern Tasmania; and it was solely the knowledge thus acquired that guided Governor King when he instructed Bowen "to fix on a proper place about Risdon's Cove" for the new settlement.

The English discoverer of the Derwent—a navigator who, though less fortunate than Admiral D'Entrecasteaux, yet merits the title of original discoverer equally with the illustrious Frenchman—was Lieutenant John Hayes, of the Bombay Marine, to whom I have already alluded. The occasion of Hayes' expedition is sufficiently curious to justify a few words of remark. It was the only exploring expedition ever sent out by the East India Company into Australian waters. In those days the great Company was at the height of its power. Its royal charter secured it an absolute monopoly of trade, not only with India and China, but with the entire East, including the whole of the Pacific Ocean. So exclusive were its privileges, and so jealously maintained, that the colonists of New South Wales could not trade with the home country except by permission of the Company. So late as the year 1806* it successfully resisted the sale in England of the first cargo of whale-oil and sealskins shipped by a Sydney firm in the *Lady Barlow*, on the ground that the charter of the colony gave the colonists no right to trade, and that the transaction was a violation of the Company's charter and against its welfare. It was urged on behalf of the Court of Directors that such "piratical enterprises" as the venture of the owners of the *Lady Barlow* must at once be put a stop to, as "the inevitable consequence of building ships in New South Wales will be an intercourse with all the ports of the China and India Seas, and a population of European descent, reared in a climate suited to maintain the energies of the European character, when it becomes numerous, active, and opulent, may be expected to acquire the ascendancy in the Indian Seas." The Lords Commissioners of Trade decided that the action of the colonists was irregular in respect to the Company's charter. Sir Joseph Banks exerted himself strenuously on behalf of the colonists, and represented to the Court of Directors that the Lords Commissioners in future cases "are disposed to admit the cargo to entry, in case the Court of Directors see no objection to this measure of indulgence towards an infant and improving colony," and further, that their Lordships intend, without delay, "to prepare instructions for the future government of the shipping concerns of the colony, on a plan suited to provide the inhabitants with the means of becoming less and less burdensome to the mother country, and framed in such a manner as to interfere as little as possible with the trade prerogatives and resources of the East India Company." It was mainly owing to Banks' diplomacy and energy that an Order of Council was obtained allowing future cargoes from Sydney to be landed and sold in England.

Brabourne Pamp., p. 14.

It is, perhaps, not surprising that the Company should have contributed so little towards the exploration of regions which it held to be an appanage to its Indian dominions, for at that time the Southern Seas offered few or no temptations of profit to a great trading corporation. As to New Holland, and Van Diemen's Land, its supposed southern extension, they were merely obstacles in the way of the lucrative China trade—jutting out inconveniently into the South Sea, lengthening the voyage and increasing its dangers. For the sake of the vessels employed in this trade, a knowledge of the Australian coast and its harbours was desirable.* It was probably with the object of finding a convenient harbour of refuge for ships following the southern route to China in their passage round the stormy South Cape of the Australian continent, that, in the year 1793, the Company fitted out an expedition destined for Van Diemen's Land. Cook and Bligh had recently brought home reports which encouraged the idea that a suitable port might be found there, and it is quite possible that rumours of the visit of D'Entrecasteaux the year before had stimulated the Board of Directors to action.

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* See Pamphlet containing a summary of the contents of the Brabourne Papers, Sydney, 1886, p. 11.

Low's Hist. of the Indian Navy, i., pp. 200-205.

Lieutenant John Hayes was appointed to the command of the expedition, which consisted of two ships, the *Duke of Clarence* and the *Duchess*, and was despatched from India to explore the coasts of Van Diemen's Land and its harbours, and to make its way back to India by the South Sea Islands and the Malay Archipelago. This service Lieut. Hayes performed in a very satisfactory manner. He surveyed the coasts of Tasmania, parts of New Caledonia, of New Guinea and other islands, his voyage extending over two or three years. Unhappily, the results of these valuable surveys were lost to his employers and to England, for the ship taking home his charts and journals was captured by a French man-of-war, all his papers were taken to Paris and have never since seen the light.† A rough sketch of the Derwent made by Hayes found its way to Sydney, and is frequently referred to by Flinders in the account of his voyage. This is all we know of his exploration of Tasmania, and of the Honorable East India Company's first, last, and only discovery expedition to Australian waters.

Flinders' Voyage, Intro., p. 94.

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* It was considered a chief object of every exploring expedition to find harbours suitable for the East India Company's ships. When Flinders was about to sail in the *Investigator* to explore the Australian coast, the Court of Directors, on being applied to, made him an allowance of £1200 as "batta money"—a practical recognition of their interest in his expedition.—Brabourne Pamphlet, p. 13.

† There is good reason to believe that Hayes' charts and journals are in the National Library in Paris, or possibly in the Department of Marine and Colonies. It would be well if an effort were made to discover them and have them published. See Appendix.

Lieut. Hayes' ships reached Storm Bay in the year 1794. He had heard of the visit of the French to these shores two years before, but knew nothing of what D'Entrecasteaux had done. He explored and surveyed the approaches of the Derwent, and sailed up that river nearly as far as Bridgewater; while, in the belief that he was making an original discovery, he gave new names to various localities. These have in some instances superseded those bestowed by his predecessor D'Entrecasteaux. Thus it is to Hayes that we owe the name of the Derwent, which has replaced the French appellation of the Rivière du Nord, and D'Entrecasteaux Channel was long known to the English by the name of Storm Bay Passage, which it bears on Hayes' chart. Other names which are still remembered are Betsey's Island, Prince of Wales Bay, Mount Direction, and, lastly, Risdon Cove.* It is said that Risdon Cove and River were named by him after one of the officers of the ship, but this I have not been able to verify.†

Flinders' Voyage, Intro., p. 138.

It was in the early spring of the year 1798 that Governor Hunter gave to Flinders—then a young Lieutenant of H.M.S. *Reliance*—the *Norfolk*,‡ a little colonial sloop of 25 tons, to try to solve the vexed question of the existence of a strait between New Holland and Van Diemen's Land. Flinders secured Dr. George Bass as his companion in the expedition, and on the 7th October, 1798, the *Norfolk* sailed from Port Jackson with a crew of 8 volunteers, taking twelve weeks' provisions. They examined the North Coast of Tasmania, entering Port Dalrymple, and sailed for the first time through the Straits, to which, at Flinders' request, Governor Hunter gave the name of Bass' Straits.*

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* Adamson's Peak, Mount Lewis, Cornelian Bay, Taylor's Bay, Court's Island, Fluted Cape, Ralph's Bay, were also named by Hayes.

† Mr. Justin Browne informs me that Risdon is a name borne by a county family of Devonshire; (see "Marshall's Genealogist's Guide," p. 524), and that it occurs also as a place name in Gloucestershire, (see also Burke's Armoury, Ed. 18.) The popular derivation from a supposed "Rest-down" may perhaps be credited to the fancy of the enterprising and pugnacious printer, Andrew Bent. So far as I have been able to discover, it first occurs in "Bent's Tasmanian Almanac" for 1827. It has been copied by West and other writers.

‡ The *Norfolk*, which has the credit of having first circumnavigated Van Diemen's Land, was built at Norfolk Island, of the pine for which that island is celebrated. She was afterwards used by Flinders in his exploration of Moreton Bay. Labilliere's Early History of Victoria. Vol. i, p. 26.

Leaving Bass' Straits the *Norfolk* sailed southwards along the West Coast—Flinders naming Mount Heemskirk and Mount Zeehan after Tasman's two vessels—and on 14th December, arrived at the entrance of Storm Bay. Flinders had with him a copy of Hayes' sketch chart of the Derwent, but had never even heard of D'Entrecasteaux's discoveries six years before. Bass, in speaking of Adventure Bay, says,—"This island, the Derwent, and Storm Bay Passage were the discovery of Mr. Hayes, of which he made a chart." More than a fortnight was employed by Flinders in making a careful survey of Norfolk Bay, and of the Derwent from the Iron Pot to a point some 5 miles above Bridgewater. In the Introduction to his *Voyage to Terra Australis*, he gives the result of his observations. Bass devoted his attention more particularly to an examination of the neighbouring country, its soil, productions, and suitableness for agriculture. He took long excursions into the country, having seldom other society than his two dogs, examining in this way the western shore of the river from below the Blow Hole at Brown's River to beyond Prince of Wales Bay, visiting various parts of the eastern shore, and ascending Mount Wellington and Mount Direction. His original journal has never come to light, but the substance of it was published in 1802, by Collins, in the second volume of his *Account of New South Wales.*

Flinders, Intro., p. 181.

Collins' New South Wales, ii., p. 183.

Flinders, Intro., pp. 181-189.

Collins, ii., pp. 143-194.

It is interesting to learn how the country with which we are so familiar struck the first visitor to its shores, when as yet the land was in all its native wildness, and untouched by the hand of man, and I shall therefore give some of Bass's observations on the country about the Derwent. The explorers had some difficulty in getting the *Norfolk* as far up the river as the mouth of the Jordan, which Flinders named Herdsman's Cove. Thence they proceeded in their boat some 5 or 6 miles higher up. They expected to have been able to reach the source in one tide, but in this they were mistaken, falling, as they believed, some miles short of it. I regret to say that Bass did not show the good taste of the

***Ibid*, p. 186.**

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* "No more than a just tribute," says the generous Flinders, "to my worthy friend and companion for the extreme dangers and fatigues he had undergone in first entering it in the whale-boat, and to the correct judgment he had formed from various indications of the existence of a wide opening between Van Diemen's Land and New South Wales."—Voyage to Terra Australis, Intro., p. 198.

Frenchmen who were so enthusiastic on the grandeur and beauty of the harbours and rivers which they had entered. He describes our noble river as a "dull, lifeless stream, which after a sleepy course of not more than 25 or 27 miles to the north-west, falls into Frederick Henry Bay. Its breadth there is two miles and a quarter, and its depth ten fathoms." He further remarks, "If the Derwent River has any claim to respectability, it is indebted for it more to the paucity of inlets into Van Diemen's Land than to any intrinsic merits of its own." Yet his impression of the country on its banks was distinctly favourable. "The river," he says, "takes its way through a country that on the east and north sides is hilly, on the west and north mountainous. The hills to the eastward arise immediately from the banks; but the mountains to the westward have retired to the distance of a few miles from the water, and have left in their front hilly land similar to that on the east side. All the hills are very thinly set with light timber, chiefly short she-oaks; but are admirably covered with thick nutritious grass, in general free from brush or patches of shrubs. The soil in which it grows is a black vegetable mould, deep only in the valleys, frequently very shallow, with occasionally a mixture of sand or small stones. Many large tracts of land appear cultivable both for maize and wheat, but which, as pasture land, would be excellent. The hills descend with such gentle slopes, that the valleys between them are extensive and flat. Several contain an indeterminate depth of rich soil, capable of supporting the most exhausting vegetation, and are tolerably well watered by chains of small ponds, or occasional drains, which empty themselves into the river by a cove or creek." Black swans were seen in great numbers, and kangaroo abounded, but Bass came to the conclusion that the natives must be few in number, as although they frequently found their rude huts and deserted fires, during a fortnight's excursions they fell in with none of the aborigines, except a man and two women, with whom they had a friendly interview some miles above Herdsman's Cove. Bass contrasts New South Wales and Van Diemen's Land in respect of their fitness for agriculture: his opinion was that they were both poor countries, but in point of productive soil the preference was to be given to Van Diemen's Land. He found on the banks of the Derwent various tracts of land which he considered admirably adapted for grain, for vines, and for pasturage, and no place combined so many advantages as Risdon Cove. Bass grows almost

Collins, ii., p. 183.

enthusiastic in describing Risdon. "The land at the head of Risdon Creek, on the east side," he remarks, "seems preferable to any other on the banks of the Derwent. The creek runs winding between two steep hills, and ends in a chain of ponds that extends into a fertile valley of great beauty. For half-a-mile above the head of the creek the valley is contracted and narrow, but the soil is extremely rich, and the fields are well covered with grass. Beyond this it suddenly expands and becomes broad and flat at the bottom, whence arise long grassy slopes, that by a gentle but increasing ascent continue to mount the hills on each side, until they are hidden from the view by woods of large timber which overhang their summits. . . . . The soil along the bottom, and to some distance up the slopes, is a rich vegetable mould, apparently hardened by a small mixture of clay, which grows a large quantity of thick juicy grass and some few patches of close underwood."

Collins, ii., p. 185.

Flinders was, however, disappointed with Hayes' Risdon River, and notices the insignificance of the little creek, which even his boat could not enter, and at which he could barely manage to fill his water casks. Among "the many local advantages of the Derwent" to which King alludes in his despatch to Lord Hobart, and which determined him to choose that place for a settlement, there is no doubt that Bass's glowing description of the beauty and fertility of Risdon filled a large place, and induced him to direct Bowen to choose its neighbourhood for the new colony.

Flinders. Intro., pp. 185, 189.

King to Hobart, 9th May, 1803.

2. The Risdon Settlement.

It is now time for us to return to Lieut. Bowen and his little colony, whom we left on the 12th September, 1803, in the *Albion* and *Lady Nelson* at anchor in Risdon Cove. A week later Bowen writes to Governor King by the *Albion*, reporting his arrival, and his definite selection of Risdon as the site of the new settlement. He seems to have accepted Risdon as a foregone conclusion, for although he tells the Governor that he had explored the river to a point rather higher than Flinders went, it does not appear that he made any sufficient examination of the western bank. If he had done so he could hardly have written to King—"There are so many fine spots on the borders of the river that I was a little puzzled to fix upon the best place; but there being a much better stream of fresh water falling into Risdon Cove than into any of the others, and very extensive valleys lying at the back of it, I judged it the most

Bowen to King, 20th September, 1803.

convenient, and accordingly disembarked all the men and stores." He could never have written thus if he had examined either Humphrey's Rivulet or the stream falling into Sullivan's Cove. Bowen's choice of Risdon does not lead us to form a high opinion of his qualifications as the founder of a new colony. On the other hand, it is only fair to take into account his difficulties. Doubtless he felt himself in a great degree bound by the instructions he had received from Governor King to fix on a spot in the neighbourhood of Risdon Cove. He also knew that Bass had carefully examined both shores of the river and had found no place so eligible. Moreover, it would be unjust to judge his choice by our present knowledge. Every settlement in an unknown and thickly wooded country must be more or less tentative, and the objections to the locality were not so evident in its original state as they now are. At present the Cove is silted up in consequence of a causeway having been built across it, but when Bowen entered it it was a fairly deep and commodious harbour. There was much to recommend the site to a new comer. When the *Albion* sailed up the Derwent the best valleys running down to the river were full of a dense scrub, most discouraging to a settler, and at that period Risdon probably presented the most open land on this side Herdsman's Cove. It was early spring, and at that season there would be a good stream of water in the creek, the open land of the Risdon valley was covered with rich and luxuriant grass, and higher up the creek was a fair amount of the good agricultural land described by Bass. The unsuitability of the valley as a site for a large town would never occur to Bowen, who was content if he could find for his handful of settlers a sufficient space for their gardens, and a few cornfields to supply their immediate requirements. The small scale of the establishment with which he was entrusted would inevitably limit his ideas. Still, after every allowance has been made, it remains evident that Lieut. John Bowen was not one of the men who are born to be the successful founders of new States.

The site of this first settlement is on the farm so well known as the home of the late Mr. Thos. Geo. Gregson, M.H.A. It lies about two miles from the landing-place of the Risdon ferry. A stone causeway crosses the cove not far from the mouth of the creek. For some 100 or 150 yards before the little stream falls into the cove it finds its way through a small marsh of some 20 acres, shut in on each side by steep hills. In Bowen's time this stream was fresh and clear-flowing; now it is brackish, sluggish, and muddy, choked with weeds and slime, and altogether uninviting in aspect. At the upper end of the marsh, where the valley suddenly contracts, a dilapidated stone jetty marks the old landing-place on the creek, at present quite inaccessible for a boat. On the narrow strip of flat ground between the jetty and the steep hill beyond are the barely discernible foundations of a stone building, the first stone store in Tasmania. From this point a road leads upwards along the hillside for some 150 or 200 yards to the top of the rise, where there is a level piece of land of no great extent, bounded on the north by rough hills and on the south sloping steeply to the valley. On the edge of this level ground, overlooking the flat and commanding a fine view of the Derwent and of the mountains behind it, stand some dilapidated wooden buildings, for many years well known as the residence of Mr. Gregson, the little cottage in front being not improbably Lieut. Bowen's original quarters. A good garden extends to the rear of the house, and in this garden, about 100 yards behind the cottage, there still stand the ruins of an oven with brick chimney, which Mr. Gregson for many years religiously preserved as the remains of the first house erected in Van Diemen's Land. From this point the valley is narrow, the ground sloping down steeply, but there is good agricultural land in the bottom, and on the northern slope where Bowen's free settlers were located—the other side being stony and barren. A plan which Bowen sent to Governor King enables us to identify the locality with absolute precision. He tells King—"We are situated on a hill commanding a perfect view of the river, and with the fresh water at the foot of it—the land excellent."

After pitching his tents at Risdon, Bowen was not idle. He set his people at once to work to build huts. During the first week he made a boat excursion up the river; examined Herdsman's Cove, and thought of locating his free settlers there. He describes the Derwent as "perfectly fresh" above Herdsman's Cove, and "the banks more like a nobleman's park in England than an uncultivated country; every part is beautifully green, and very little trouble might clear every valley I have seen in a month. There are few rocky spots except on the high hills, and in many places the plough might be used immediately; but our workmen are very few and very bad. I could with ease employ a hundred men upon the land about us, and with that number—some good men among them—we should soon be a flourishing

Bowen to King, 20th September, 1803.

Bowen to King, 27th September, 1803, *per Lady Nelson.*

colony." Next week he made another trip up the Derwent, but without further results. He sends King a plan of his settlement,* and already within a fortnight of his arrival he had got quarters built for his soldiers and prisoners, had located his free settlers on their five-acre allotments up the valley about a quarter of a mile from his tent, and had Clark, the stonemason, at work building a stone store.

King to Hobart, 1st March, 1804.

He had—probably in accordance with King's instructions—named the new settlement "Hobart,"† after Lord Hobart, the Secretary of State for the Colonies.

His Returns, dated "Hobart, Van Diemen's Land, 27th September, 1803," show an effective strength of 22 men—21 convicts and their overseer—of whom 2 were in charge of stock, 4 employed on buildings, (viz., a blacksmith, carpenter, and two sawyers), the bulk of the convicts forming a town gang. The three women are returned as "cutting grass," probably for thatching. Of the stock, the Government owned 9 cattle and 25 sheep, the Commandant had a mare, and the Doctor a cow, while the Officers and Birt and Clarke, the free settlers, were possessors of 7 sheep, 8 goats, and 38 swine.

Bowen to King, 27th September, 1803.

Within a fortnight from his landing, as I have said, Bowen had all his people housed, and reports to King that the soldiers and prisoners have got very comfortable huts. He fixed his own quarters on the spot where Mr. Gregson's house now stands; the soldiers' huts were a little behind Dr. Mountgarret's quarters, and the prisoners' huts were placed on the brow of the steep bank overlooking the creek. (See plan). The Commandant tells King that he has not yet drawn any lines for the town, waiting till he can cut down the large timber which obstructed his view. To lay out a town in such a situation must have been a difficult problem, for his little settlement was perched on the top of a high almost precipitous bank, on the edge of a very narrow gully, and the narrow plateau on which it stood, shut in at the back by rough hills, did not afford room for a fair sized village. But the difficulties of the locality were as nothing to the difficulties of the human material out of which he had to form his colony.

Ibid.

The soldiers of the New South Wales Corps, who formed his guard, and on whom he had to depend for the maintenance of order, were discontented, almost mutinous. Within a week of his arrival they were grumbling at the hard duty of mounting one sentry during the day and two at night. The Commandant thought they had been spoilt by too easy a life in Sydney, and begged the Governor to send him down an active officer or sergeant who would keep them to their duty.

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* See Appendix.

† "Town" was not added to the name until some time after the settlement was removed by Collins to Sullivan's Cove.

As to the prisoners, they were of the worst class, ill behaved, useless, and lazy. Indeed, when we find that some of the worst offenders in New South Wales had been sentenced by the Criminal Court in Sydney to serve a certain number of years at Risdon Creek, we cannot wonder at Bowen's complaints of their conduct, nor can we be surprised that he was able to effect so little.

Meanwhile, Governor King did not forget the interests of the new colony. In his reply to Bowen's first letters, he expressed himself as well pleased with the selection of Risdon, and with the progress that had been made with the settlement. He also promised the reinforcements for which Bowen asked, and, accordingly, towards the end of October the *Dart* brig was despatched to the Derwent. She took 42 prisoners—of whom 20 were volunteers—and these latter were told that, if their behaviour was good, they should be allowed at the end of two years to choose between settling at the Derwent and returning to Sydney. The Governor also strengthened the Military force by sending down 15 soldiers under the command of Lieut. Moore. He strongly urged Bowen to leave their discipline entirely to their officer, to give them good huts, full rations, a plot of ground for a garden, and to employ them on military duty only, so that they might have no just ground for complaint. The *Dart* took six months' supplies of pork and flour for the new arrivals, and also two carronades which had belonged to the *Investigator*, and as to the care of which King gave the Commandant very special cautions. No more free settlers were sent, as the Governor wished first to get a better knowledge of the country and of its suitableness for agriculture. To this end he sent down James Meehan, a surveyor who had done good work in New South Wales under Surveyor-General Grimes, and had recently formed one of the party who had made the survey of Port Phillip in the *Cumberland*. Meehan was to be employed in surveying and making observations on the soil and natural productions of the colony, and was to advise with respect to the distribution of the town, church, and school lands,

King to Bowen, 18th October, 1803.

King to Hobart, 24th October, 1803.

King to Bowen, 18th October, 1803.

fortification, court-house, settlers' allotments, and government grounds for the purpose of agriculture and grazing. He remained some four months at Hobart, returning to Sydney in March, 1804, after having completed the first surveys in Tasmania. Flinders' map shows that Meehan explored from the Coal River in a north-east direction, returning by way of Prosser's Plains and the Sorell District, but we have no particulars of the result of his observations.

Knopwood's Diary, 6th March, 1804.

Bowen's little colony now numbered something like 100 souls. It had been established about two months, and might fairly have been expected to have made at least a start towards definite progress. But it was predestined to failure. The few meagre facts that can be gleaned from the Record Office papers show that matters went most persistently wrong. The Commandant may not have been to blame for this ill success—possibly no man could have achieved success with the like material. The first arrivals had been bad, the second batch was certainly no better. We have Collins' testimony, very emphatically given, that many of them were "abandoned, hardened wretches"—"more atrocious than those imported from the gaols of England." The story of the escape of seven of these convicts, under the leadership of one Duce, gives us an idea of their lawlessness, their ignorance, and their utter recklessness. One night, Duce and his six companions stole the Commandant's boat as she lay in the cove, gained possession of two guns, and got away down the river. Some of the party wanted, without compass or provisions, to run for New Zealand, which they thought could easily be done. Others, not quite so ignorant, preferred to try to make Timor. Violent quarrels ensued, but they kept on their course along the east coast, living on fish and such vegetable food as they could collect on the shore, and constantly on the verge of murderous conflict, until they reached Bass Strait. Here one of the party was left on a desolate rock, Duce threatening to shoot any one who interfered. The rest made Cape Barren Island, where they fell in with a sealing party. Duce and three others designed to seize the vessel, but were betrayed by their companions. The sealers overpowered them, and put the four, with some provisions, on one of the islands, where they left them. Whether they perished, or whether they helped to swell the number of lawless runaways who for so long a time infested the islands in the Straits, no one knows.

Collins to King, 29th February, 1804. Harris's statement.

The soldiers were almost as great a trouble to the Commandant as the convicts. They were always discontented, occasionally mutinous. At times, instead of guarding the stores from depredation, they connived at the prisoners plundering them. An occasion of this sort, when a soldier was proved to have been accomplice in a robbery, led to Bowen taking a very extraordinary step. He could not try the man, not being able to constitute a court martial, and was so puzzled to know what to do with him, that when the *Ferret* whaler chanced to put into the Derwent, he actually determined to leave his post, and himself take the culprit to Sydney for trial. Accordingly, he sailed from Risdon for Sydney in the *Ferret*, on the 9th January, 1804.

King to Hobart, 1st March, 1804.

With all these signs of the utter disorganisation of the settlement, we cannot wonder that no progress had been made, and that when Collins arrived a few weeks later, he found that after five months' residence not a single acre of land was in preparation for grain upon Government account.

Collins to King, 29th February, 1804.

But the Risdon settlement was already doomed, owing to a series of events of which neither Governor King nor his Commandant was yet aware. Before Bowen had made his first abortive start for the Derwent, and before Governor King's despatch of 23rd November, 1802, respecting French designs could have reached England, the Home Government had taken a resolution which—not by any intention of theirs—was destined to bring Lieut. Bowen's colony to an end, by its extinction in a more systematic and extensive settlement on the banks of the Derwent. In January, 1803, an Order in Council appointed Lieut.-Colonel David Collins, of the Royal Marines, Lieutenant-Governor of a settlement intended to be formed at Port Phillip, in New South Wales. The new establishment sailed from Spithead on the 24th April, 1803—a month before King had given Bowen his commission as Commandant of Hobart—had just left Cape Town when Bowen sailed from Sydney in the *Albion*, and arrived in Port Phillip on the 9th October, 1803.

Downing-street to Admiralty.

Knopwood's Diary.

This is not the place to give an account of Collins' proceedings, at Port Phillip or elsewhere, except in so far as they affected the fortunes of the Risdon settlement. Suffice it to say, that Collins found, or fancied, that Port Phillip was unfit for a settlement, and after corresponding with Governor King, and dawdling near the Heads for some three months, he finally decided to remove his establishment to the Derwent. Thereupon, King sent Collins a letter addressed to Bowen, directing the latter to hand over to Collins his command at the Derwent,

King to Bowen, 26th November, 1803.

and to send back to Port Jackson his detachment of the New South Wales Corps. And so a game of cross purposes began. For while Collins was still fuming and fidgetting at Port Phillip, balancing the comparative advantages of Port Dalrymple and the Derwent, and gradually making up his mind in favour of the latter place, Bowen had sailed from Risdon in the *Ferret* with his burglarious soldier, and had presented himself to the astonished Governor King at Port Jackson. The Governor seems to have taken no pains to conceal the annoyance he felt at his Commandant leaving his post on so trifling an occasion, and sarcastically remarks in a despatch to Lord Hobart, that Bowen's "return was occasioned by the necessity he conceived himself to be under of bringing up a soldier who had been implicated with the rest in robbing the stores." He was the more vexed at this inopportune return, as he knew that Collins was on the point of leaving Port Phillip, and he was particularly anxious that the Risdon Commandant should be at hand to give the new Lieutenant-Governor the benefit of his experience and knowledge of the locality.

9th January, 1804.

23rd January.

1st March, 1804.

Ibid.

The colonial cutter *Integrity* had just been launched. She was hastily fitted for sea, and Bowen was ordered to return in her to the Derwent forthwith, calling at Port Phillip to join Collins, to give him all necessary assistance, and accompany him to Risdon. The *Integrity* sailed on the 5th February; but Bowen's ill luck still attended him. When he reached Port Phillip he found only a remnant of Collins' establishment, under the charge of Lieut. Sladden, the Lieutenant-Governor himself having sailed for the Derwent in the *Ocean* with the bulk of his people two or three days before. Bowen accordingly hastened on with his despatches, but shortly after sailing the cutter's rudder fastenings carried away, and she was placed in a very dangerous position. However, she managed to reach Kent's Bay, Cape Barren Island, and there they found a sealing party belonging to the American ships *Pilgrim* and *Perseverance*. The necessity for getting on was imperative; so Bowen made a verbal agreement with the American skipper, Captain Amasa Delano, to carry them on in his ship, and afterwards, if required, to proceed to Port Jackson. From the diary of the Chaplain of Collins' party, the well known Rev. Robert Knopwood, we learn that the *Pilgrim* cast anchor in Sullivan's Cove on 10th March, and that at six in the evening, a boat brought ashore "the Governor of Risdon Creek, Lieut. Bowen, of the Royal Navy."

30th January, 1804.

King's Order to Palmer, 29th August, 1804.

Knopwood's Diary, 10th March.

It must have proved a considerable mortification to the Governor of Risdon Creek to learn the events that had occurred during his unlucky absence. Lieutenant-Governor Collins had arrived in the evening of the 15th February, and next morning had landed at the Risdon settlement under a salute of 11 guns from the *Ocean*. On landing, he had been received by the officer in charge, Lieut. Moore, of the New South Wales' Corps, and the rest of the establishment—consisting of the doctor, storekeeper, and military force of 16 privates, one sergeant, and one drum and fife. After examining the camp, gardens, water, &c., the new Lieutenant-Governor had at once come to the conclusion—which indeed was pretty evident—that Risdon was not, in the Chaplain's words, "calculated for a town." Accordingly, on the following day the Governor, with the Chaplain and Wm. Collins, had gone exploring, and had returned much delighted, having found at a place on the opposite side of the river, six miles below Risdon, "a plain well calculated in every degree for a settlement." Forthwith the tents of the new establishment had been struck and taken on board the ships, which had dropped down the river to the selected spot, and anchored in Sullivan's Cove. So that on the 20th February—five days after Collins' arrival—his tents had been pitched at the mouth of the creek on the present site of Hobart, and the glory of Risdon had departed.

Knopwood.

Bowen's settlement had had its own internal troubles, which, no doubt, Lieut. Moore duly reported to the Governor of Risdon Creek. On the 21st February, the day after the founding of the new Hobart at Sullivan's Cove, a further batch of five convicts had escaped from Risdon, having found means to steal half a barrel of gunpowder from under the very feet of the sentry, and also two "musquets," with which they had got off into the woods. The runaways, however, did not find the woods inviting enough for a permanent residence, and one of them having voluntarily come in, the others followed his example next day, bringing the arms and ammunition with them. It was too troublesome and expensive to send them to Sydney for trial; they were therefore heavily ironed, and kept to work as a gaol gang.

Collins to King, 29th February

The only consolation that the Risdon Governor could have found in his adversity—besides the greater opportunities of good fellowship which were now afforded him, with no doubt better fare than the salt pork and bread, which had hitherto been the regulation diet—was the consideration that the religious wants of his people, about which Governor King had been so emphatic, were now under proper regulation, and that on Sundays, when the weather was not unfavourable, the Chaplain, after divine service at Sullivan's Cove, had occasionally gone over to Risdon in the afternoon, and, as he phrases it, "done his duty to all the convicts, &c., &c.," dining afterwards with Dr. Mountgarret.

26th March.

17th April.

King to Palmer, 29th August, 1804.

King to Hobart, 20th December, 1804.

Captain Delano, meanwhile, was making a good thing out of Bowen's misfortunes. The *Integrity* was still lying at Cape Barren Island, disabled, and she had to be brought on. So after enjoying and returning the hospitalities of the place for a fortnight, the American captain sailed again for the Straits, with new rudder fastenings for the disabled vessel, and in less than a month the *Pilgrim* once more appeared in the Derwent with the *Integrity* in company. The *Pilgrim* sailed away a few days later to continue her sealing voyage, and her captain carried with him not only the reward of an approving conscience, but also Bowen's bill on Governor King for £400. When the bill was presented in the following August, King's surprise was considerable, and he made some vigorous protests. But the bill was in due form, for services performed, and the Governor had to pay. He could only relieve his feelings by writing to Lord Hobart in strong terms as to the American's conduct; but he says, "I did not consider I could, with that respect due to the British character, either curtail or refuse payment of the bill, notwithstanding the extortionate advantage that had been taken of Mr. Bowen's necessities, and his not entering into a written agreement."

American sealers—Murrell's statement.

King to Hobart, 20th December, 1804.

We hear again of Captain Delano and his party a month or two later, and they seem to have been very undesirable visitors. Not only had they been smuggling spirits against the stringent regulations and decoying prisoners, but they had made themselves still more obnoxious by their brutal treatment of a sealing party at Kent's Bay belonging to the *Surprise* sloop, of Sydney. According to the statement of the master of the *Surprise*, he had been flogged and nearly killed by Delano's men for venturing to come into the Straits and interfere with them by killing seals in their neighbourhood. Governor King was inclined to take vigorous measures to put a stop to the lawless conduct which was then only too common amongst the American sealers in Bass' Straits, and proposed to the Home Government that he should be authorised to go the length of seizing their ships as the only means of teaching them better behaviour.

But to return to the fortunes of the Risdon Settlement.

Lieutenant-Governor Collins was altogether disappointed with the condition of Bowen's colony, and made a very unfavourable report on it to Governor King. The site was quite unsuitable; the landing-place on the creek was choked with mud, and only accessible at high tide; the stores were placed on a low position, and likely to be flooded by any heavy rain; the land was by no means first class; and the rivulet, on which they depended for their fresh water, and which in September had been a running stream, was in February dwindled to a few pools of dirty water. The indifferent capabilities of the place had not been made the most of. No grain had been sown, and no Government land had been even prepared for sowing. Dr. Mountgarret, and Clark and Birt, the free settlers, had each about five acres ready, but they had no seed, so Collins had to supply them with sufficient to crop their land. The five months' occupation had been wasted; there was nothing to show but a few wretched huts, cottages somewhat better for the officers, and a few acres of land roughly cleared of trees and scrub. The people were in a miserable condition, having been for some time on two-thirds of the standard rations, so that Collins had to supply them with food, and even to remove their starving pigs to his own camp to save their lives. A more dismal failure for a new colony could scarcely be imagined. It is difficult to decide how far Bowen was to blame for this wretched state of things. The human material that had been given him to mould into shape was desperately bad. Collins says that the officer in charge on his arrival (probably Lieut. Moore) described them "as a worthless and desperate set of wretches;" and this language does not appear to have been too strong. The Sydney authorities seem to have taken the opportunity of Bowen's settlement to rid themselves of their worst criminals, including the most turbulent of the United Irishmen, who had lately given so much trouble by their rising in the older colony. Even the soldiers of the New South Wales Corps, sent to curb these undesirable colonists, were lazy and mutinously inclined. It is a satisfaction to know that Collins eventually shipped the whole lot back to Sydney—both soldiers and convicts, with but few exceptions—so that they never had any part in the new Hobart.

Collins to King, 29th February, 1804.

Collins to Hobart, 31st July, 1804.

Collins to King, 29th February, 1804.

Collins to Hobart, 31st July, 1804.

Collins to Hobart, 3rd August, 1804.

Collins to King, 29th February, 1804.

Collins did not interfere with Bowen or with Lieut. Moore in their command, but left them in uncontrolled charge. Indeed, he seems to have been only too anxious to wash his hands of Risdon and all its works. Governor Bowen and the Risdon officers, however, made the best of their circumstances, and, if we can trust the chaplain's

Ibid.

diary, took life easily—shooting, hunting, excursionising, and exchanging frequent visits with the officers of the new camp. Towards the end of March Mr. Knopwood goes to Risdon for a few days, and "they caught six young emews the size of a turkey, and shot the old mother." On Easter Sunday, after Divine Service, they all go to the chaplain's marquee at the camp, and "partook of some Norfolk ham, the best we ever eat." At 4 P.M. he adjourns to Lieut. Lord's to dinner, "and was very merry." Mr. Knopwood records many visits to Risdon, and excursions with Bowen up the river, to Mount Direction, to Ralph's Bay, and other places. "The Governor of Risdon Creek," as Knopwood called him, had, however, enough trouble with his refractory people. His soldiers had long grumbled at the sentry duty as too hard for their small numbers; and the discontent at last broke out into direct mutiny. On Sunday, 22nd April, the men flatly refused to mount guard, and became so insolent and insubordinate that Lieut. Moore promptly put four of the ringleaders into irons, and took them down to Sullivan's Cove. Lieut.-Governor Collins sent the mutineers under a guard on board the Colonial cutter *Integrity*, then on the point of sailing for Port Jackson. At the same time a plot was on foot amongst some of the Irish convicts at Risdon. Their object was to seize the storehouse, supply themselves with provisions, and make good their escape from the settlement. On the discovery of the plot three of the ringleaders were forthwith flogged, and to prevent further mischief Captain Bowen and Mr. Wilson, the storekeeper, a few days later took the mutinous prisoners to Norfolk Bay in the Risdon whaleboat. "Eight of them, and all Irishmen," remarks the chaplain. They were left on Smooth Island (now known as Garden Island), with a month's provisions, and Bowen went on to explore the River Huon.

Knopwood, 26th March.

1 April.

Collins to King, 24th April, 1804.

With that fatality which always kept Bowen out of the way when he was wanted, an important and disastrous event occurred at Risdon in his absence. This was the first affray of the English with the natives. It was on the 3rd May, 1804, that this first of the long series of fatal encounters between the two races took place. Up to this time it does not appear that any natives had been seen in the neighbourhood of Risdon. Knopwood relates that there had been some friendly intercourse with the tribe on the other side of the river, and that some of them had come to Collins' camp. We also learn from him that he and Bowen had seen many natives in the neighbourhood of Frederick Henry Bay. The blacks had always shown themselves shy and suspicious, but relations had hitherto been quite friendly. The unhappy event of the 3rd May sowed the seeds of a hostility on the part of the blacks, which, exasperated from time to time by mutual injuries, filled the colony with deeds of outrage and horror, with savage murders of innocent settlers, and almost equally savage retaliation, until the native race was nearly exterminated, and the miserable remnant removed to Flinders' Island, to perish of slow decay. Of the origin of the affray the accounts are very contradictory. Two of these are contemporary; one recorded by Mr. Knopwood in his diary, the other in a letter by Lieut. Moore, the officer in charge of Risdon. The Chaplain says, under date Thursday, 3rd May:— "At 2 P.M. we heard the report of cannon once from Risdon. The Lieut.-Governor sent a message to know the cause. At half-past 7, Lieut. Moore arrived at the camp to Lieut.-Governor Collins, and I received the following note from Risdon:—

DEAR SIR,

I beg to refer you to Mr. Moore for the particulars of an attack the natives made on the camp to-day, and I have every reason to think it was premeditated, as their number far exceeded any that we ever heard of. As you express a wish to be acquainted with some of the natives, if you will dine with me to-morrow, you will oblige me by christening a fine native boy who I have. Unfortunately, poor boy, his father and mother were both killed; he is about 2 years old. I have, likewise, the body of a man that was killed. If Mr. Bowden wishes to see him dissected, I will be happy to see him with you to-morrow. I would have wrote to him, but Mr. Moore waits.

Your friend,

J. MOUNTGARRET.

Hobert, six o'clock.

The number of natives, I think, was not less than 5 or 6 hundred. J. M."

Knopwood continues:

"At 8, Lieut. Moore came to my marquee and stayed some time; he informed me of the natives being very numerous, and that they had wounded one of the settlers, Burke, and was going to burn his house down, and ill-treated his wife, &c., &c."

Lieut. Moore's letter—a copy of which is preserved in the Record Office—is dated Risdon Cove, 7th May, 1804, and is addressed to Governor Collins. He says—

SIR,

Agreeable to your desire, I have the honor of acquainting you with the circumstances that led to the attack on the natives, which you will perceive was the consequence of their own hostile appearance.

It would appear from the numbers of them, and the spears, &c., with which they were armed, that their design was to attack us. However, it was not until they had thoroughly convinced us of their intentions, by using violence to a settler's wife, and my own servant—who was returning into camp with some kangaroos, one of which they took from him—that they were fired upon. On their coming into camp and surrounding it, I went towards them with five soldiers. Their appearance and numbers I thought very far from friendly. During this time I was informed that a party of them was beating Birt, the settler, at his farm. I then despatched two soldiers to his assistance, with orders not to fire if they could avoid it. However, they found it necessary; and one was killed on the spot, and another found dead in the valley.

But at this time a great party was in the camp; and, on a proposal from Mr. Mountgarret to fire one of the carronades to intimidate them, they departed.

Mr. Mountgarret, with some soldiers and prisoners, followed them some distance up the valley, and have reason to suppose more was wounded, as one was seen to be taken away bleeding. During the time they were in camp, a number of old men were perceived at the foot of the hill, near the valley, employed in preparing spears.

I have now, Sir, as near as I can recollect, given you the leading particulars, and hope there has nothing been done but what you approve of.

I have the honor to be, &c.

William Moore,
Lieut. N.S.W. Corps.

It will be noticed that in this letter Lieut. Moore, who had every reason to represent the conduct of the natives in the worst light, can show no direct act of hostility. He assumed that they were hostile, from their numbers; and, for the beating of Birt, and the proposed burning of his hut, he has no evidence to offer but a report brought to him in the midst of the panic which the appearance of the blacks had caused among his people. That the doctor's proposal to fire the carronade should have induced savages, who did not understand the language and had never seen fire-arms, to withdraw, is too great a stretch on one's credulity. We know, from Knopwood, that the gun was fired; but, whether it was loaded with blank cartridge or with grape we have no means of deciding.

Military operations against the aborigines of V.D.L., House of Commons Paper, 23rd September, 1831, p. 53.

The only other eye-witness of the affair whose account we have directly contradicts Lieut. Moore; and his story looks probable, like the story of a man who had kept his head amidst the general panic. This witness is one Edward White, who was examined before Governor Arthur's Aborigines' Committee in 1830. In considering his evidence it should be remembered that at the time he gave it the exasperation of the whole colony against the blacks, on account of their brutal outrages, was at fever heat, and the witness had every inducement to represent their conduct in this affair in an unfavourable light. White came to the colony with Bowen, and was an assigned servant to the settler Clark. He was the first man who saw the approach of the natives. He was hoeing new ground on the creek near Clark's house, which was about half a mile up the valley behind the camp. As he was hoeing, he saw 300 natives, men, women, and children, coming down the valley in a circular, or rather a semi-circular, form, with a flock of kangaroo between them. They had no spears, but were armed with waddies only, and were driving the kangaroo into the bottom. On catching sight of him they paused astonished, and, to use his expression, "looked at him with all their eyes." White had very probably been accustomed to the Port Jackson natives; at any rate, he says that he felt no alarm at the approach of the blacks, but he thought it advisable to go down the creek and inform some soldiers. He then went back to his work. On his return the natives were near Clark's house. They did not molest him or threaten him in any way. Birt's house was on the other side of the creek some hundreds of yards off, and White was very positive that so far from attacking Birt or his house, they never even crossed over to that side of the creek, and "were not within half a quarter of a mile" of the hut. He knew nothing of their going into the camp itself; but they did not attack the soldiers, and, he believed, would not have molested them. When the firing commenced there were a great many of the natives slaughtered and wounded, how many he did not know.

H. of Com. Paper, 23rd Sept., 1831, p. 52.

The Rev. Mr. Knopwood gave evidence before the same committee. He stated that he had heard different opinions as to the origin of the attack; that it was said the natives wanted to encamp on the site of Birt's hut, half a mile from the camp, and had ill-used his wife, but that the hut was not burnt or plundered. They did not attack the camp, but our people went from the camp to attack the natives, who remained at Birt's hut. He thought only five or six natives were killed. The general opinion was that the blacks had gone to Risdon to hold a corrobberry.

These accounts throw great doubt on the accuracy of Lieut. Moore's version of the affair. It is significant that Knopwood, who had every opportunity of learning the truth at the time, should state so positively that the natives never left the neighbourhood of Birt's hut, but that the soldiers went out to attack them.

It seems clear that the natives had no hostile intention in their visit, and this was the conclusion of Governor Arthur's committee. Everything goes to show that they were a party coming from the east, probably the Oyster Bay tribe, engaged on a hunting expedition, and that they were more astonished than the English on coming into contact with them. The fact of their having their women and children with them is a perfectly conclusive proof that no attack was contemplated. We can easily understand how terrifying to the Risdon people must have been this sudden inroad of a horde of excited savages, yelling and gesticulating. Utterly ignorant of their customs, unable to understand them, or to make themselves understood, the panic of the English, convinced that the natives had collected in force to destroy them, was natural enough. Doubtless the soldiers shared in the general scare, and, moreover, were probably quite inclined to take pot shots at the black savages. But Lieut. Moore ought not to have lost his head. He at least should have grasped the situation, and restrained his men. A little more presence of mind on his part, the exercise of a little tact and forbearance, and a collision would have been avoided, the natives would have been conciliated, and the history of the black race in Tasmania might have been different. That the aborigines of Tasmania would in any case have melted away before the white man, as the aborigines of the other colonies are melting away, is certain; but if it had not been for Lieut. Moore's error at Risdon, a war of extermination, with all its attendant horrors, might have been averted.

H. of Com. Paper, 23rd Sept., 1831, p. 53.

Knopwood, 11th May.

Collins to King, 15th May, 1804.

There is little to add respecting this occurrence, except that, according to White, some of the bones of the slaughtered natives were sent in two casks to Port Jackson by Dr. Mountgarret, and that the chaplain, ever anxious to extend the bounds of his church, records that he went to Risdon a week later and "xtiand a young native boy whose name was Robert Hobert May"—the good chaplain having thus the honor of bestowing his name on this first innocent aboriginal Christian. Collins tells Governor King that the baptism had taken place without his knowledge or consent, and when he found that Dr. Mountgarret intended to take this two-year old native to Sydney, he had the boy brought to the camp and directed that he should be returned to his own people, for fear they should think he had been killed and eaten by the English. "For," he remarks, "we have every reason to believe them to be cannibals, and they may entertain the same opinion of us."* The incident made Collins very apprehensive of further attacks; and, indeed, a few days after this affray the crew of the cutter, while collecting oyster shells on the river bank opposite Hobart, was attacked by a numerous party of natives, and beaten off with stones and clubs.

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* There is no foundation for this opinion.

As I have already observed, Lieut.-Governor Collins was very reluctant to have anything to do with the Risdon people, and would willingly have shipped them all off to Port Jackson; but he now received express and positive instructions from Governor King to take over the command; and, accordingly, on the 8th May, (immediately after Bowen's return from the Huon), a General Order was issued, notifying that he had taken upon himself the command of Risdon; that Lieut. Bowen was to continue in the direction of the settlement under him until further orders, and that the officers and prisoners were to return to Port Jackson in the *Ocean*. The stores were immediately removed to Sullivan's Cove, the few remaining prisoners being victualled from the Hobart camp. The stock was also removed—17 head of cattle, and 45 sheep and lambs; and, a few days later, the whole of the prisoners were removed to the camp, where they could be kept at work in one gang, under a strict guard and a vigilant overseer.

Collins to King, 15th May, 1804.

Collins to Hobart, 31st July, 1804.

Although Collins badly wanted more military, he did not care to keep the small detachment of the New South Wales Corps, as he had at first thought of doing; for, out of the 23 soldiers, one had been taken to Sydney by Bowen for robbery, and he himself had sent four others thither on a charge of mutiny. He therefore determined to despatch them all to Sydney, where a Court Martial could be assembled to correct and punish their evil propensities. Of the convicts, 50 in number, there were only 11 men and 2 women whom the Governor deemed it expedient to keep.

Ibid.

It was not until the 9th August that the *Ocean* got under way for Sydney, and carried with her the whole civil and military establishment,—Capt. John Bowen, Dr. Mountgarret, Wilson the storekeeper, the turbulent soldiers and the mutinous convicts, 40 or so, who had formed the first Settlement in Van Diemen's Land. Thus ended the first and abortive Hobart.

Knopwood.

The only free settler who remained was Richard Clark, who had been made superintendent of stonemasons. Both King and Collins speak highly of his character and capacity. Collins gave him a similar position in the new Hobart at Sullivan's Cove; and in this office he acquitted himself well. A few sheep were given him, and a location of 200 acres on the other side of the river, nearly opposite Hobart.

Collins to King, 3rd August, 1804.
***Ibid*, 31st July, 1804.**
***Ibid*, 15th May.**

King to Collins, 30th September, 1804.

Collins to King, 29th February, 1804.

The other settler, Birt, had applied for and obtained leave to remain; but at the last moment he changed his mind, and sailed with the rest in the *Ocean*, which brought him under the displeasure of Governor King, who refused to allow him a grant of land. Dr. Mountgarret also at first desired to stay, as he had been combining commerce with medicine, and had a large stock on hand which he wished to dispose of; but he, eventually, changed his mind, and he also sailed in the *Ocean*.

King to Collins, 30th September.

Knopwood, 3rd Sept.

King to Palmer, 29th September.

King's Commission, 31st August, 1804.

The net balance of the Risdon Settlement, therefore, remaining with Collins was Richard Clark and the 11 male and 2 female convicts above mentioned. Collins afterwards ordered all the houses at Risdon to be pulled down; but it does not appear whether this was carried into effect. The *Ocean* did not arrive in Port Jackson until the 23rd August, King having almost given her up for lost. Dr. Mountgarret got a fresh appointment as Surgeon to the new Settlement at Port Dalrymple, under Lieut.-Colonel Paterson.

King to Collins, 30th September, 1804.

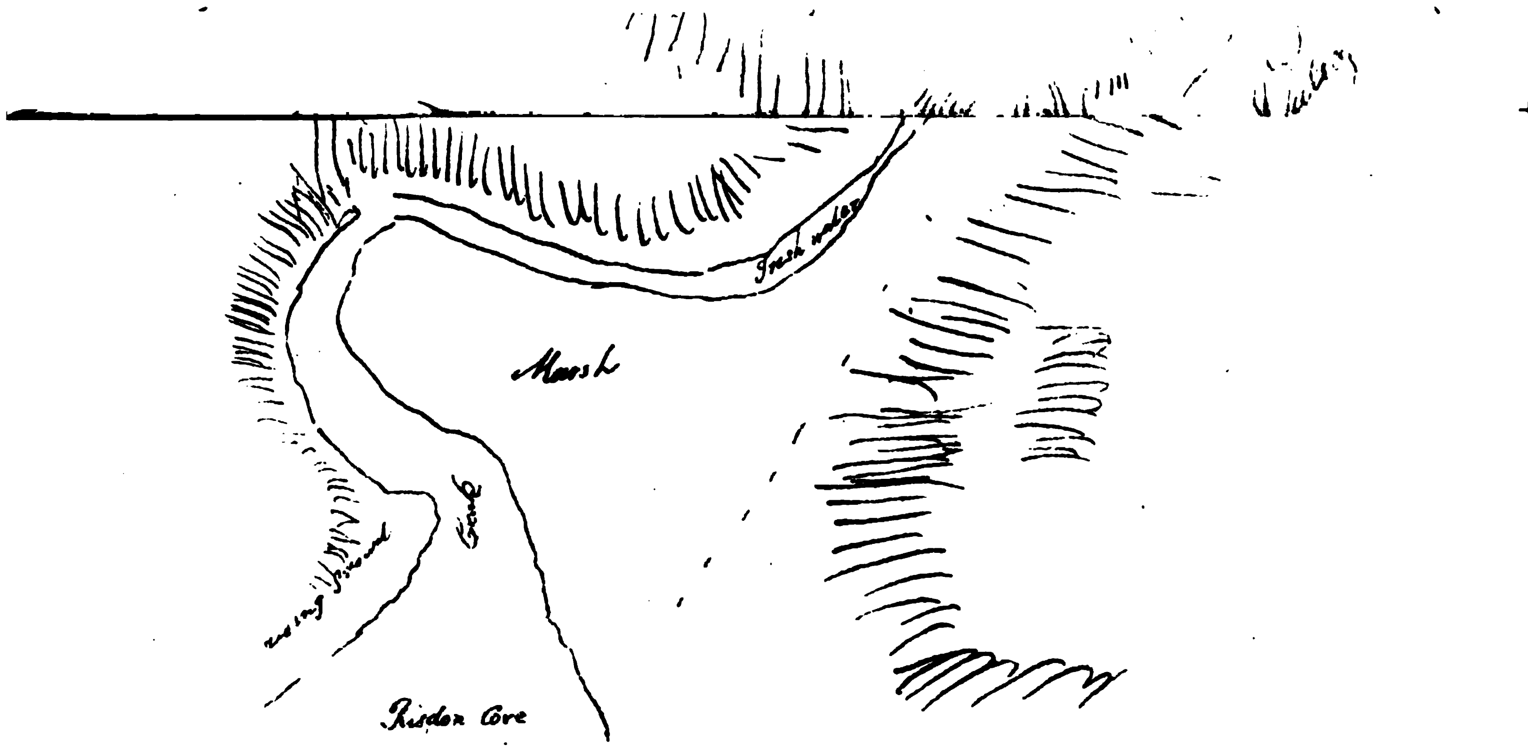
Lieut. Bowen had left a mare at the Derwent for which he had paid £120, and he offered her to King at that price. The Governor agreed to purchase her on Government account, and paid Bowen with four cows, which he stopped out of his next shipment to Collins. This was the first horse taken to Van Diemen's Land.

King's memo. to Palmer, 29th September, 1804.

Bowen to King, 17th November, 1804.

King to Hobart, 20th December, 1804.

It only remains to state what more we know of the Governor of Risdon Creek. On his arrival at Sydney he was desirous of returning to England, in order that he might again enter on active service in the navy. Governor King had offered him the munificent pay of 5*s*. per day from the 30th June, 1803, when he first sailed from Sydney in the *Porpoise*, to the 24th August, 1804, when he returned thither in the *Ocean*, viz., 420 days, at 5*s*. per day, or £105—exactly one hundred guineas for 14 months' governorship—certainly not an extravagant salary for a Governor—not enough to pay his passage to England. He refused the colonial pay offered, and addressed a letter to King, in which he reminds the Governor that pecuniary considerations had not been in his view in accepting the appointment, but simply the advancement of his interest in His Majesty's naval service; but that, as he had been at great expense consequent on that appointment, he trusted the Governor would recommend him to the Home authorities for a sufficient remuneration. King enclosed the letter to Lord Hobart, strongly recommending the application, as he believed Bowen had done his utmost to forward the service he undertook, and expressing a hope that, in


Fresh water
Marsh
Creek
rising Ground
Risdon Cove

addition to this, his character, and that of his father and other relatives in the navy, might open a way for the promotion he was so anxious to obtain. King also paid his passage home in the *Lady Barlow*, amounting to £100.

It would seem that Lieut. Bowen obtained the promotion he sought. Jorgensen—who, however, was not the most accurate of men—states in his autobiography that the Commandant of Risdon was a son of Commissioner Bowen. Mr. Leslie Stephen's "Dictionary of National Biography," in a notice of Captain James (afterwards Admiral) Bowen, who performed brilliant services at sea during the French wars, mentions the fact that he was one of the Commissioners of the Navy from 1816 to 1825, and that his son John, also a captain, after serving in that rank through the later years of the war, died in the year 1828.

Ross' Hobart Town Almanac, 1835.

With this brief notice of its founder, I close the story of the first Settlement at Risdon Cove.

APPENDIX A.

CAPTAIN HAYES' CHARTS.

A manuscript map, evidently the result of Lieut. Hayes' surveys of the Derwent, was recently discovered by Mr. James R. M'Clymont in the National Library. Mr. Alfred Mault has obtained through his friends in Paris a *fac simile* of this map, which he has courteously placed at the disposal of the Royal Society, and a photo-lithograph of it will appear in this year's volume of the Society's Proceedings. The map bears the imprint of A. Arrowsmith, London, but apparently was never published. Mr. Mault thinks it is Lieut. Hayes' own draft of his chart prepared for publication. This is probable; but the map in question is not identical with the sketch Flinders refers to, since that sketch showed Risdon Cove, which does not appear in Mr. Mault's *fac simile*. His Excellency the Governor has kindly interested himself in the matter, and it is probable that through his influence some further information respecting Hayes' expedition may at last be brought to light.

APPENDIX B.

Population of the Australian Colonies at the time of the Risdon Settlement (1803):—

New South Wales	7134
Norfolk Island	1200
Van Diemen's Land	49
TOTAL	8383

See Collins' "Account of New South Wales," ii., 333.

ADDENDA ET CORRIGENDA.

"THE FRENCH IN VAN DIEMEN'S LAND."

(See Royal Society's Transactions, 1888.)

P. 101, Note.—The name "Australia."—In a despatch to Lord Bathurst, dated April 4th, 1817, Governor Macquarie says—"The Continent of *Australia*, which I hope will be the name given to this country in future, instead of the very erroneous and misapplied name hitherto given it, of *New Holland*, which, properly speaking, only applies to a part of this immense continent."—Labilliere's "Early History of Victoria," i., 184.

P. 100, line 3.—"Quiros' Terre du St. Esprit, the coast between Cooktown and Townsville."—It is so placed by De Brosses in the chart appended to his "Navigations aux Terres Australes." It is now identified as the island of Espiritu Santo, one of the New Hebrides group.

P. 103, line 16.—"Cox (1789)."—Through inadvertence Cox is mentioned as having touched at Adventure Bay. He did not enter Storm Bay, but visited Oyster Bay and Maria Island.

P. 110, line 9.—"In spite of his safe conduct from the French Admiralty, [Flinders'] ship was seized as a prize."—In a pamphlet published in Sydney in 1886, containing a summary of the contents of the Brabourne Papers, it is stated that amongst the despatches carried by the *Cumberland* was one from Governor King pointing out the opportunities which Port Jackson afforded for the concentration of troops, which might at any time be sent against the Spaniards in South America, and it is suggested that the discovery of this despatch amongst Flinders' papers gave Governor De Caen a plausible excuse for the detention of the English navigator. It is difficult to believe that this surmise has any sufficient foundation, since, if such a despatch had come to the hands of De Caen, he would certainly have produced it as a justification of his action, and would not have been driven to the paltry pretext drawn from an entry in Flinders' journal.

It may be mentioned that in a paper dated 1809—while Flinders was still a prisoner—Governor King states that there was no doubt that the French entertained the design of attacking New South Wales from Mauritius. He says that Baudin had taken correct plans of Port Jackson, and had explored the passage to Mauritius through Bass Straits, and that had he lived another year the Commodore would most likely have visited the colony for the purpose of annihilating the settlement.—Labilliere's "Early History of Victoria," i., 121. See also Jorgensen's Autobiography in Ross's "Hobart Town Almanack for 1835," p. 138.

DISCUSSION.

The Rev. F. H. Cox referred to the interest always manifested in tracing the past history of peoples and places. Mr. Walker had taken up the position of a Goldsmith in relation to this deserted village of Risdon, and traced a reason for this desertion. In a sense he might claim a relationship to Mr. Knopwood mentioned in the paper, in that he had succeeded Mr. Bedford, and Archdeacon Davies, who had immediately succeeded Mr. Knopwood.

The Rev. Geo. Clarke congratulated the writer of the paper, and referred to the value of such information being placed on record. It also removed several mistaken impressions which had been allowed to gain ascendency.

Mr. Mault asked Mr. Walker if the chart referred to by him was similar to one which he had brought under that gentleman's notice a few days ago.

Mr. Walker said it was not. The Sydney chart gave further particulars than in the one mentioned.

Mr. Mault explained that he had, through the medium of friends in Paris, obtained permission to copy certain of the maps in the archives at Paris. There was one map alleged to have been issued by Arrowsmith, but of which no trace could be found in the publisher's house. The theory he formed was, that Lieut. Hayes was seized, together with his charts, by French vessels when proceeding to London, and that this map was in manuscript at the time of seizure. He should be happy to place the copy at Mr. Walker's disposal should he so desire.

Sir Lambert Dobson endorsed the remarks made by the Rev. Geo. Clarke. He referred to the statement made in Hopwood's Journal, in which it was asserted that the river was endangered by the number of whales, and also to the fact that a former Governor had enjoyed snipe shooting near Hobart. All this was changed and gone. He did not think the full blame for the exterminatory war lay on the shoulders of Lieut. Moore. It was bound to come in time. He also mentioned that the site of Hobart was densely covered with scrub, and therefore the first settlers might be forgiven for choosing a more favourable spot. These changes that had occurred he hoped were for the better.

His Excellency congratulated the writer of the paper. He endorsed the opinion made by Mr. Mault respecting the existence of old records in France. He would be prepared to use his influence in the direction of making a request to the Home Government on the subject. (Applause.)

SMUT IN WHEAT.

By T. Stephens, M.A., F.G.S.

The letter of Mr. Joseph Barwick, read at the last meeting of the Royal Society, is specially interesting as showing a spirit of intelligent enquiry, and a desire to work out the solution of one of the numerous problems connected with natural phenomena, which are to some extent a matter of uncertainty even to those who have devoted their lives to scientific research. Mr. Barwick's long experience as a practical farmer, and the results of his special experiments, have shown him that the origin and spread of the parasitic disease to which he refers is involved in much obscurity. He has, however, perhaps not sufficiently realised that a thorough knowledge of the general history of these low forms of vegetable life must be acquired before one can be sure of a satisfactory basis for experiments. The absence here of facilities of access to standard works and recent reports increases the difficulty of investigation, but the main facts of the propogation of the disease in question are sufficiently well-known for all practical purposes. Smut and bunt may be regarded as convertible terms. Though they are spoken of as distinct species by some authorities, I can say from personal knowledge that what is called smut in Tasmania bears the same name in some parts of England, while elsewhere it is known as bunt. It is a minute fungus belonging to the family *Coniomycetes*, sub-order *Ustilaginei*, and has been described at different times under various names, as *Uredo caries*, *Uredo fœtida*, *Tilletia caries*, and *Ustilago segetum*; but it is pretty well-known now that the form in which the disease is always recognised is simply one of the conditions or stages in the life of a fungoid plant, which in other stages is known by a different name. In the case of animal parasites, such as the sheep fluke (*Fasciola hepatica*), the stage in which it appears to the ordinary observer is only the final development in the sheep of a cycle of changes, one of which, at least, cannot take place except in the body of an animal belonging to a totally different class. Again, the disease in sheep called " sturdy " or " staggers "—the common term in Tasmania is a " cranky " sheep "—is derived from the ova of the tape worm (*Taenia*) in a dog which, voided on the grass, are taken up by the sheep with its natural food, and find their way through the circulation into the brain, and are there developed into a new form called *Cœnurus cerebratis*, which, lodged near the inner surface of the skull and pressing on the brain, produces the symptoms which are well-known to most sheep farmers. So the blight known as "corn mildew" (*Puccinia graminis*) has been definitely connected with a fungus (*Æcidium berberidis*) found on the wild barberry, and is said to have disappeared from some localities when this hedgerow tree had been extirpated. As regards smut, it is sufficient to know that the disease generally springs from seed infected by the minute spores of the fungus known by that name, which explains the use of sulphate of copper or some other fungus destroyer, as a preventive, and it is probable that the intermediate changes take place in different parts of the wheat plant, reaching their final development in the ear. It is well known that self-sown wheat, such as grows on headlands, is very rarely affected by the disease, and the probable explanation of this fact is that it is not so much exposed to infection as that which has passed through the steam-threshing machine. The myriads of spores beaten out from even one smutted ear form a cloud of impalpable slightly glutinous dust, which adheres to the grain with which it comes in contact, and this applies also to hand-threshed wheat, though in a much less degree. When the machines first came into use, English farmers still preferred to use the flail for wheat intended for seed, because in machine-dressed wheat some of the grain is often so much broken by the beaters as to be unfit to produce healthy plants. They do not omit in either case to use some preventive against smut, the experience of generations have proved that if properly applied, it very rarely fails to check its ravages. Of course wheat selected from sound ears and rubbed out by hand, as described by Mr. Barwick, would be in a condition analogous to that of self-sown wheat, having been free from exposure to the ordinary causes of infection. I doubt very much whether any trials of seed at the Botanical Gardens could be of much practical value in a matter of this kind; but further experiments by Mr. Barwick and other intelligent farmers might prove interesting. As the mode of dressing wheat against smut varies considerably, and some kinds of treatment may do as much harm as good, I will conclude these remarks with a brief description of the process adopted by the best farmers in the North of England, where it was always regarded as an almost infallible preventive. A solution is prepared by dissolving powdered sulphate of copper in water, at the rate of 2ozs. to a pint for each bushel of wheat. The grain is emptied on a floor, a little of it is shovelled to one side by one person, while another sprinkles the solution over it, and this process is continued until the whole quantity is gone over. The heap is then turned repeatedly, the men working with shovels opposite to each other. After lying for a few minutes the grain is ready for sowing either by hand or machine. The seed ought not to be steeped in the solution, but merely wetted. A too strong solution may kill the seed as well as the fungus, and damaged grains are probably often destroyed by the ordinary process of pickling; while too long soaking in even a weak solution may cause premature germination, resulting in a badly-rooted and unhealthy plant.

Discussion.

Mr. R. M. Johnston said he had studied this matter 17 or 18 years ago, and had found that the same form of fungoid growths prevailed in all these cases. At that time he took occasion to make enquiries among the western farmers as to the surroundings which usually proved most favourable to the development of the pest, and the prevailing opinion was that it was most prevalent in newly cleared lands, adjoining forest lands, and that the further removed the land was from the timber growth, the pest sensibly decreased. Perhaps, in view of all this, it might be wise on the part of farmers, when selecting seed wheat, to obtain it from districts which were free, or almost free, from the pest.

Mr. Mault directed attention to the fact that the Agricultural Department of the Privy Council, Great Britain and Ireland, issued reports by experts on all these subjects, and that copies thereof were furnished to the Tasmanian Parliamentary Library. These reports embraced works dealing with the latest information, respecting both agriculture and fruit culture, and he thought the fact was not generally known that copies existed in the colony.

Mr. Ward called attention to the fact that sulphate of copper contained a percentage of sulphate of iron, which was a decidedly more powerful germicide than sulphate of copper. It also appeared that the iron sulphate formed a chemical compound with the cellulose portion of the coating of grain.

SMUT IN WHEAT.

By F. Abbott, Superintendent of the Botanical Gardens.

At the last meeting of the Royal Society a communication from Mr. Joseph Barwick was read on Smut in Wheat, in which he relates his own tests for the purpose of ascertaining the cause, and suggests that further experiments should be carried out in the Botanical Gardens for a like purpose. Having carefully read Mr. Barwick's communication, I can but think that he, as well as others with whom I have conversed, are not acquainted with much that has been done of late in the investigation of this subject, and that, therefore, the following general notes may interest many:—The various species of Ustilaginæ, especially U. Segetum, causing smut in wheat and other plants have been under observation by a host of competent scientific observers for many years past, and it is only of late, after much patient research and many thousands of anatomical observations, more in the laboratory than the field, that the life history of the fungus has been elucidated. In the *Gardener's Chronicle* for February 23 and March 2, a detailed account of recent discoveries as to the nature of Ustilaginæ is given by H. Marshall Ward. As this account is replete with information at present little known, arrangements have been made for its publication in *Webster's Gazette* for August and September, where full details may be found. To others into whose hands this publication may not come, the following brief notes may be of interest: The dark substance, popularly called smut, is in reality dense masses of spores arising in tufts at the ends of fine filaments, formed in the ovary or young grain at the expense of the food material, which is destroyed. These spores, of which there are enormous numbers, every ear of smutted corn producing, it is estimated, not less than ten millions, are capable of germinating when placed under favourable circumstances, and multiply their conoidal cells with great rapidity in the soil; fresh manure or manure washings greatly favour their development, and should in all cases be avoided; in material of this description the fungus produces generation after generation in vastly increasing numbers, waiting as it were for the coming of its host, into which it quickly penetrates, and with which it continues to grow. The spores ripening in the grain of the smutted cereal are garnered with the latter, become scattered on the healthy grain and are sown with it, the fungus germinating at the same time as the cereal, produce their prymocella, the germ tubes of which penetrate the embryo plant. Experiments have proved that the fungus is only able to effect an entrance to its host by attacking the embryonic tissue; once inside, it gradually permeates the whole plant, extending with its growth from cell to cell, and finally meeting in the young fruit conditions favourable to the production of spores. As the fungus can only enter the tender tissue at the color of the young seedling, it is very important that the cultivator should endeavour, by the selection of good, sound, clean seed only, and a good and properly prepared seed bed, to encourage a rapid growth from the first. Anything that tends to retard this growth in its earliest stages lengthens the time during which it is possible for the fungus to effect an entrance, and greatly increases the chances of infection ; a few hours even may make all the difference, for though thousands of sporidea may be near the color of the young seedling, no entrance can take place unless the germ tubes reach it at the critical time. Experiments have been made with a view of infecting the leaves and stem of the growing corn with the germinating spores, but have invariably resulted in failure, except on the tender growing point, where the tissues remained sufficiently soft for the sporidea to effect an entrance, but under natural conditions this point is not subject to attack. As regards suitable dressings, there is yet a large field open to investigators ; if freeing the seed coat from spores superficially attached was all that was necessary, the matter would be simple enough, but much more than this is required, as the smut fungus may be present in the soil itself, ready to attack the grain at the critical time. Dressings, to be effectual, must be sufficiently permanent to destroy in the soil any prymocelia or conoidal cells that may happen to be in proximity with the seed corn. The following are said to be as efficacious as any at present known :—A strong solution of Glauber's salts, in which the seed grain is to be well washed, and afterwards, while still moist, dusted over with quicklime ; by the application of the lime the caustic soda is set free and destroys any fungoid growths it may come in contact with. The application of copper sulphate to the grain as a dressing before sowing is a well-known remedy, but though it destroys the fungus it greatly retards the growth of the wheat, which is an objection to its use. Lime applied after the copper salt neutralises its prolonged effect, and is a good practice. The presence of lime itself in the soil is likewise beneficial. The foregoing notes are the result of the labours of many competent investigators, who have bestowed much time and care on the subject, the elucidation of which necessitated thousands of artificial cultures of the fungus and microscopical examinations. One or two points in Mr. Joseph Barwick's communication will be better accounted for, if viewed with the light thrown on the subject by recent investigations. Mr.

Barwick points out in one of his experiments that it was the strong and deep-rooted plants that escaped infection; this is only what might have been looked for, as upon the strength and rapidity of growth of the plant depends in great measure its immunity from infection. And, again he points out that it was only in the annual species of grasses that he detected smut; here again is precisely what might be expected, as the perennial grasses would have become too consolidated at the part subject to infection for the fine filaments of the fungus to effect an entrance, and thus would remain free from attack. With reference to the suggestion that experiments should be undertaken in the Botanical Gardens for the purpose of throwing light on the subject, I doubt much if any good result could be obtained by such experiments. There is no doubt but the life history of fungoid pests effecting cultivated plants is one of great interest to the cultivator, but the subject is so intricate, the same fungus presenting many varying forms during its growth, that if any satisfactory progress is to be made in its elucidation, it is absolutely necessary that cultivators in many and varying localities accurately record facts coming under their notice, and these facts, which are only so much crude material, will need to be arranged and investigated by the mycologist. Only after very many and oft repeated experiments, made for the purpose of verification, have been made can any definite result be obtained.

A NEW DARK-FIELD MICROMETER FOR DOUBLE-STAR MEASUREMENT.

By A. B. Biggs.

Figs. 1, 2, 3, 4.

I often think it must be very pleasant for the ardent votary of science to have unlimited means at his command for obtaining such apparatus as he requires in the pursuit of his favourite study; apparatus elaborately finished, and perfectly adapted for the work for which it is designed. Yet it too often happens that such apparatus becomes a mere toy in the hands of its possessor, he merely contenting himself with its possession, and the enjoyment of its beauties. On the other hand, it remains a fact that some of the grandest achievements of science are due to workers who have had to be content with very simple and perhaps roughly constructed apparatus, the outcome of their own ingenuity, called forth by the necessities of the case. The writer claims the applicability of the foregoing remarks to his own case only so far as they relate to the necessity of trusting mainly to his own resources in his very limited field of scientific work. The instrument of which the following is a description, has been in this way the outcome of his necessity. Its special function is the measurement of very minute angular distances, such as those of double stars, giving at the same time the angle of position with reference to the meridian.

A few preliminary remarks on some of the existing forms of Micrometer may help to elucidate the special adaptability of the instrument to be described for the work for which it was designed. The *Reticle* Micrometer is specially useful for mapping star fields, but a driving clock for the telescope is almost essential. My first Micrometer was of this form, and consisted of a photograph (on thin micro. coverglass) of a scale, ruled on a sheet of glass coated with black paint, and having lines cut through the paint with the point of a penknife. The figure was a square subdivided into 400 by parallel lines each way (20 × 20). Each interlinear space was divided by a line running from the centre to the outside of the square each way. The one for use with my highest power is only $\frac{1}{10}$ in. square, the spaces between the lines being only $\frac{1}{200}$ in. It is, however, quite inadequate for double-star work.

The *Ring* Micrometer is adapted for distances occupying a considerable portion of the field, by timing the passages across the ring. But unless the passage describes chords at some distance from the diameter the measures are unreliable. It involves somewhat tedious calculation for differences of declination.

A very useful dark-field Micrometer, embracing the greater portion of the field, is the *Bar* Micrometer. My own form of it is a modification of that used by Lacaille in the preparation of his valuable Catalogue of Southern Stars. His was a rhomboid cut out of a piece of thin brass and placed in the focus of the eye-piece; mine is an equilateral triangle, formed of watch hair-spring. The differences of right ascension and declination are obtained by timing the passages in and out of the triangle. It is a very useful instrument for faint objects which will not bear illumination of the field, and especially for comet work.

The Micrometer, *par excellence*, for general work is doubtless the *Filar Position Micrometer*. A description of this is of course superfluous to those at all acquainted with telescopic work. The measurement is effected by parallel spider lines, moved to and fro by fine screws, the measu es being read off by the number of turns, and by graduations on the screw heads. The scale is revolved by a pinion and wheel, so as to make a cross spider line intersect the objects to be measured, and the position angle is read from a graduated circle. This instrument is specially convenient for differences of declination; but for direct *oblique* distances, is difficult to use without a steady driving clock for the telescope. It is a delicate and expensive aparatus.

Many other forms and methods of Micrometer measurement are adopted, which it will be unnecessary to further refer to. I will now go on to describe my own, first giving the general principle.

If a strip of glass (A), coated with black paint, and having two fine converging lines cut through the paint, at an angle of 10 or 15 deg., be placed face to face with another piece of glass (B), similarly coated, and having a single line ruled across it—this line being placed so as to cross the lines of A —the intersection of the lines will show as luminous points by transmitted light. On sliding the slip A along, these points will recede or approach until they coalesce at the point of the angle. Now, if an image of these points can be projected into the field of the telescope, and brought into juxtaposition with the pair of objects whose angular distance is to be measured, we obviously have the means, by a proper adjustment of the points as to distance and parallelism, of determining the measurement required. The position of the slide A is read upon a graduated scale, the value of which is determined by well-known astronomical methods.

The projection of the image into the telescope is effected by means of an adjustable camera-lucida, constructed from a selected micro. cover-glass and attached to the eye-piece. The whole carrying arrangement of the glass plates is made to revolve in a suitable frame, so that the luminous points may be brought into parallelism with the pair of stars to be measured, and the angle read off from a graduated circle on the rim, the zero point being first ascertained by revolving the scale until a star shall run along the single line of plate B. The difference of readings will give the position angle with reference to the meridian, it being supposed that the telescope is mounted equatorially.

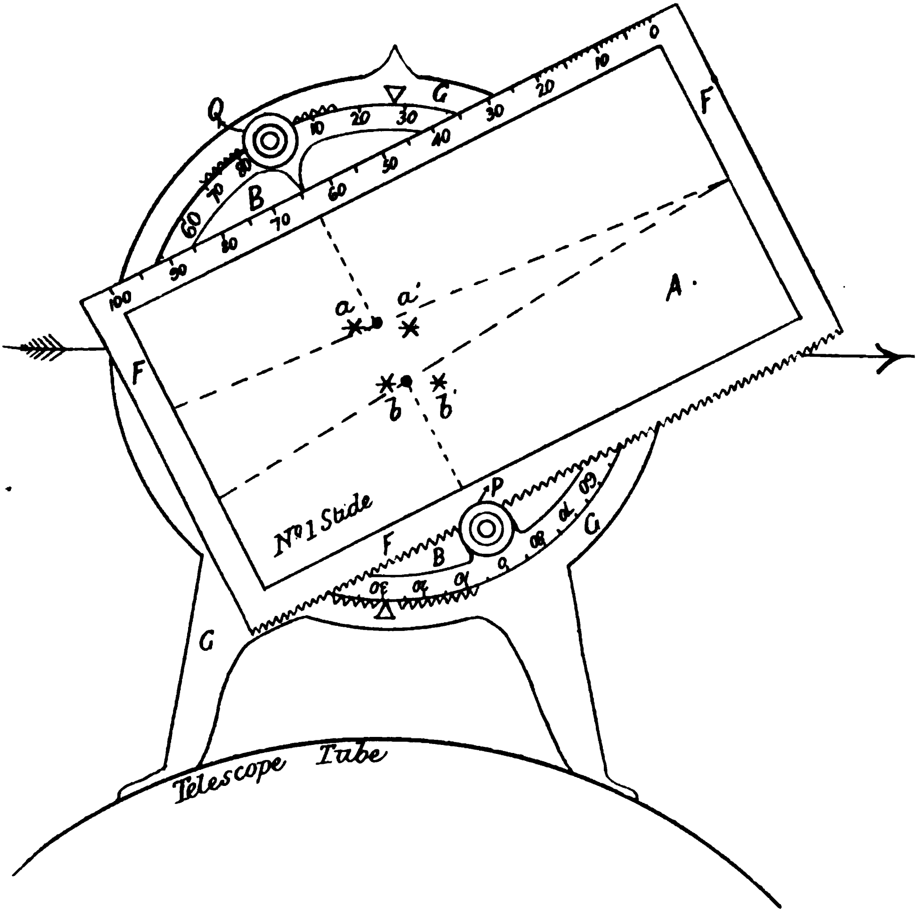
The foregoing will, I think, make the principle clear. Dimensions will depend very much on the size of the telescope. In my case, the glass slides are 7in. x 4in., the opening of the circle or ring 4in. The telescope is a Newtonian reflector —speculum 8½in. The apparatus is fixed perpendicularly on the telescope tube at a distance (towards the speculum end) of 19½in. from the eye-tube, this distance being adopted for convenience, as giving a value of ½ sec. of arc with the power I generally use for double stars. The sliding glass slip fits into a brass sliding frame, or carrier, which moves by a rack and pinion. A scale of 100 divisions is engraved on the side of the frame, answering to the length of the glass slide. (See A and F, Fig. 1.)

For the glass slides I prepare a coated slip three lengths in one, ruling the diverging lines the whole length of the slip, from the angle at one end to an opening of about 3½in. at the other. This slip is then cut into 3 lengths (commencing from the point of the angle), each length being exactly equal to the 100 divisions on the frame. This gives scale readings to 100, 200, 300, the glasses being interchangeable in the frame. The whole arrangement, with its graduated circle, revolves in the frame which supports it, by a pinion in the support, working in a toothed wheel on the circle. My apparatus is fitted with a small electric lamp (2½ candle), with a contact conveniently near the eye-piece. At the back of the lamp is a concave reflector, to throw a parallel beam of light upon the scale. It is of advantage to *frost* the back surface of the glass (next to the lamp). The coated surfaces should be next each other without rubbing.

The measurement is effected, not by *direct coincidence*, but by *comparison*. Supposing we are working without a driving-clock, the "ghost," as I will call it (*i.e.*, the image of the points), is brought to about the middle of the field, and the star brought into position with it. The circle is then revolved until the "ghost" is sensibly parallel with the line joining the components of the star, and the slide moved to correspond with the distance. When these adjustments are perfect, as the star approaches and recedes from the "ghost," the four points will form a perfect parallelogram. (Fig. 2.)

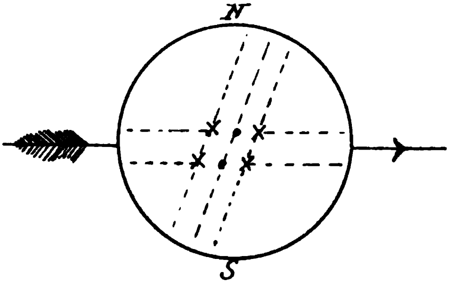
Practically it will be found that the eye is very sensitive to

FIG I (PAGE 3)



The Arrow shows the path of the Star across the field

FIG 2



• • The "Ghost"

× × × × The star passing the "Ghost"

FIG 3 PAGE 4

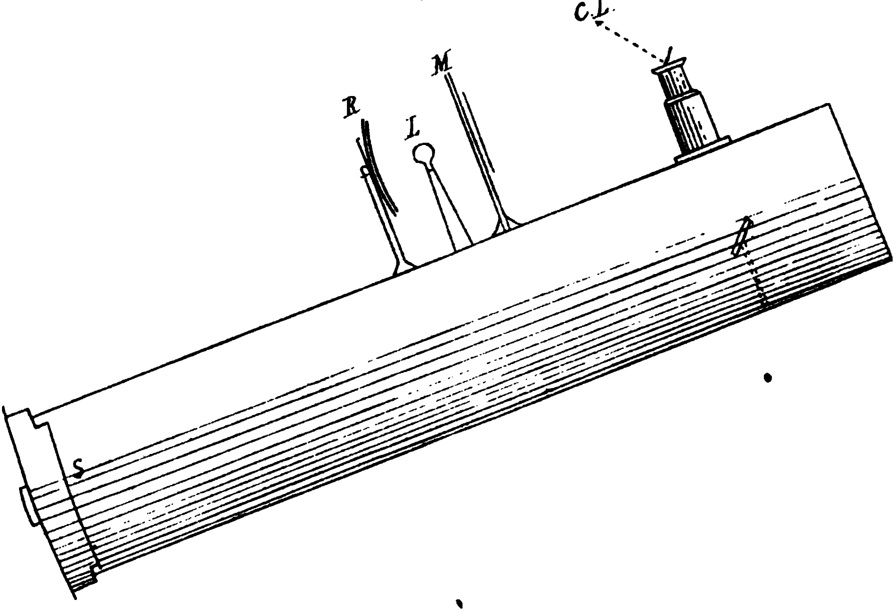
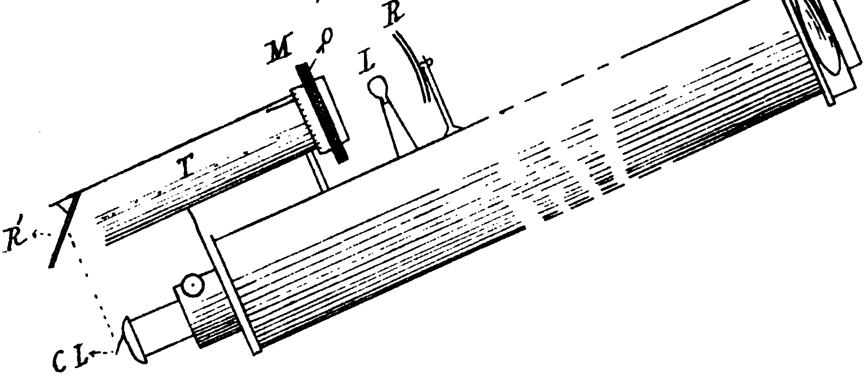


FIG 4 PAGE 4



any irregularity in the figure; I think more so than with respect to coincidence with spider lines, as in the use of the filar micrometer, especially when, without a driving-clock, the object is moving obliquely across the field, and only a momentary contact can be obtained in passing. The similarity of the images in the former case favours the comparison. Fig. 3 shows the general arrangement of the apparatus as applied to a Newtonian reflector.

My first experimental arrangement was fitted to my 3in. refractor, and was a very primitive affair, the carrier being of tin, revolving in a paper tube. For a rofractor, a different arrangement from that described above has to be adopted. With the Newtonian reflector, the position of the scale being at right angles with the direction of vision, a single reflection at 45deg. throws the image into the eye-piece. With the refractor, on the other hand, the only practicable position for the apparatus is on the body of the tube towards the object-glass; that is in the direction of vision. This necessitates an intermediate reflection at an angle of 45, to throw down the image of the scale upon the camera-lucida. (Fig. 4.)

The apparatus admits of very considerable elaboration and development; as, for instance, star photometry. Further; the whole apparatus may be made to travel to or from the eye on a suitable slide, having a graduated scale; a single plate with parallel lines being placed in the plate-holder. By this arrangement planetary discs and differences of declination may be read off, as with the filar micrometer. I will not, however, add to the tediousness of this paper by further reference to this matter.

I must, in closing, express my obligation to Mr. Alex. Wallace, of this city, a clever amateur mechanic, for his kindness and generosity in the successful construction of my present apparatus.

NOTES ON THE DISCOVERY OF A GANOID FISH IN THE KNOCKLOFTY SANDSTONES, HOBART.

By Messrs. R. M. Johnston and A. Morton.

Two Plates.

The recent discovery of the very perfect remains of a Ganoid Fish, closely allied to the genus Acrolepis, in one of the beds of the Knocklofty sandstones, is of the greatest interest. Several fossil fishes are said to have been found previously in the flagstone quarry near the Cascades, but, unfortunately, the quarrymen regarded them as being of little or no importance, and although, from curiosity, one or two specimens had been preserved for a time by one of the workmen, they were soon lost or thrown away. The specimen now referred to was discovered by Mr. H. Nicholls, who, with commendable thoughtfulness, at once presented it to the Tasmanian Museum.

Fortunately the casts of the specimen are remarkably perfect. The only parts imperfect, or missing, are the ventral fins, part of the anal fin, and the anterior part of the head. The strongly pronounced heterocercal tail and the scales of the body are remarkably well preserved. The following is a description of the fish, which is named, provisionally, in honour of His Excellency Sir Robert Hamilton, to whom, as its President, the Royal Society is so much indebted for the enthusiastic manner in which he has ever promoted its interests.

Acrolepis? Hamiltoni, *Johnston and Morton.*

Body compressed, elliptical, elongate; length from snout to end of caudal fin about 7 inches; length of body $5\frac{3}{4}$ inches; depth at a vertical line through occiput, 12 lines, increasing to 14 lines at greatest depth near ventrals, and from thence gradually tapering to peduncle, where it measures 5 lines; length of heterocercal tail—which is inclined upwards at an angle of about 22 degrees—14 lines; length of lower ray lobe of caudal, 5 lines; length of head about $1\frac{1}{4}$ inches, or scarcely one-sixth of the total length; length of dorsal, about 8 lines; fin low, with fine rays, probably 15 or 16; anterior end situated about 39 lines from end of caudal, and the posterior distant about 31 lines from the same point. The anal fin is inconspicuous and imperfectly preserved, but it appears to be similar to the dorsal, and it is situated fully half the length of that fin nearer the tail. The ventrals are scarcely visible, but appear to be small; and the root is only about 10 lines distant from a vertical drawn through posterior portion of head. Pectorals about 7 lines in length, and consists, apparently, of about 15 slender rays.

There are 56 rows of small rhomboid scales, longitudinally arranged in an inclined dorso-ventral series; the caudal series being more perceptibly angled than the anterior series. The inner surface of each scale is alone visible, from which it clearly appears that each one is finely ridged longitudinally, as in the scales of Acrolepis. There are usually 4 slightly curved ridges, radiating longitudinally from posterior angle of rhomboid scale to the two inner ones, almost invariably becoming furcate as they approach anterior inner margin; the outside one on either side smaller and almost invariably simple. The upper margin of tail is markedly serrate, indicating the presence of numerous pointed fulcral scales.

The only Australian fish which appears to come near it is the well-known *Myriolepis Clarkei*, Egerton, but it is evident from the description and drawings that the Tasmanian Ganoid has relatively much smaller fins, and the scales, though belonging to a specimen half the size, are relatively much larger and consequently less numerous.

AGE OF THE ROCKS IN WHICH THE FISH REMAINS OCCUR.

The discovery of this interesting fossil is another proof of the aqueous origin of the important series of sandstone beds, of which the section from Cascades to Knocklofty affords the best and most fully developed example. Although the shales contain impressions of what appear to be fucoids, the evidences are not sufficient to determine whether these basins were estuarine or lacustrine; or whether the waters were fresh, brackish, or salt. Ganoid fishes of the period are found under all such conditions; and therefore their discovery in such deposits prove little further than to indicate the *aqueous* origin of the beds in which such remains occur. It is most probable that the waters were of the nature of brackish lagoons. The exact position of these sandstones in relation to the Mesozoic Coal Measures, on the one hand, and the Upper Paleozoic Mudstones, on the other, has ever been one of much doubt.

It is true a similar series of sandstones at Adventure Bay appear to immediately succeed the Upper Carboniferous Coal Measures without any sign of stratigraphic break; and again at Passage Point this succession appears to be very complete in immediate relation to beds of the Upper Marine series. But the absence of fossil evidence, and the manner in which the several deposits are separated from each other, by distance or faults and intrusive rocks, make it a doubtful matter whether these apparently similar formations are, in reality, members of the same horizon. The evidence of breaks in the series at Knocklofty, and on the Huon Road near the Old Toll Bar, also adds perplexity when relationships are sought to be established. And much observation is yet needed before it is possible to satisfactorily determine the true relations of the various separated sandstone formations, lying either between the Upper Paleozoic Mudstones or Upper Carboniferous Coal Measures, and the Coal Measures of Mesozoic Age.

SECTION FROM THE CASCADES TO KNOCKLOFTY.

The series of sandstones and shales between the bed of the creek at the Cascades, and the blow of intrusive greenstones forming a conical knoll above the highest sandstone quarry on Knocklofty, is about 800 feet thick, measuring from the bed of the creek. At this point it is not known to what depth the series extend, but it is probable the thickness altogether will exceed 1,000 feet.

The following is a description of the series exposed, taken in ascending order:—

1.	Yellow fissile sandstones, splitting up into thin evenly bedded flagstones	20
2.	Greyish or blackish micaceous bed of flaggy sandstone, with hardened ferruginous nodules, sometimes enclosing remains of fossil fish	5
3.	Friable mottled shales—green, red, or yellow—with obscure impressions of minute strap-shaped plants (apparently slightly unconformable with No. 3)	60
4.	Thick bedded sandstones—white, red, and yellow, worked throughout for building stone with thin bands of fine friable yellow or grey shales intercalated irregulary at intervals	715
	Total Thickness	800

OBSERVATIONS OF COMET OF JULY AND AUGUST, 1889, TAKEN AT LAUNCESTON, TASMANIA, LAT. 41° 26′ 01″; LONG. 9° 48′ 31″ EAST.

By A. B. Biggs.

The comet was first observed here on 26th July, faintly visible without telescope. Tail about 1deg. in length, its position angle estimated at 140°±. Nucleus, sharp and starlike, about 7 mag., surrounded with considerable nebulosity. Position (approximately) R.A., 13hrs. 21½min. S. Dec. 23° 07′. (This and the position readings given below were merely the readings of the rough home-made circles of the equatorial, and make no pretension to exactness.) The star comparison measures were all taken with a *Bar* Micrometer, equilateral triangle, and are apparent difference measures only, uncorrected for refraction, etc. Owing to persistent cloudy and unsettled weather, very few opportunities for star measures were afforded. Circle readings for position were taken as often as opportunity offered.

Telescope.—Reflector, 8½in., silver on glass by Browning.

APPARENT DIFF. R.A. AND N.P.D. COMET FROM STAR.

Date.	L.M. Time.			Diff. R.A.	Diff. N.P.D.	No. of Obser.	Star.	Comet.	Approximate Place of Comet.				
									R.A.				
Aug.	h.	m.	s.	m. s.	m. s.				h.	m.	s.	°	
2	20	31	13	+0—18·75	+ 2 15·8	2	b(see below)	S.F.	14	24	30	− 5	0
2	21	57	42	+3—02·5	−14 52·2	1	a (104 Virg.)	N.F.		,,		,,	
3	22	11	09	−1—06·7	+ 0—36·8	3	c	S.P.	14	31	30	− 3	05
3	22	27	25	+0—20·5	−17—26·3	3	d	N.F.		,,		,,	
15	21	55	13	−1—08·4	+20—03·3	6	17 Serp.	S.P.	15	31	—	+14	51
17	22	24	23	+1—52·5	−23—28·8	1	19 Serp.	N.F.	15	38	—	+16	43
27	19	40	05	−1—07	+24—21	3	10 Herculis	S.P.	16	5	—	+23	25½

NOTES AND REFERENCES.—August 2. *a.*—104 Virg. (?) *b.*—About 7 mag., close to a small nebula, "70" (Proctor's Atlas), looking like a detached wisp of the comet. *c.*—A minute star (10·11m.).

August 3.—"*c*" "*d*"—Not identified, each 7m.±
,, 17.—Brightness of nucleus, about 8m.
,, ,, —Tail estimated about 10′ length.
,, ,, — ,, Position angle, 120°±

N.B.—The brightest star available always selected, except as to *b*, August 2, on account of proximity to nebula.

RECENT MEASURES OF "*a.* CENTAURI."

By A. B. Biggs.

As an illustration of the efficiency of the Micrometer described in my former paper, I give the following series of measures, in their order, extending from 26th May to 21st November, 1888:—

Distance Readings	15″·60	16″·01	17″·13	17″·40	16″·93	17″·16
Position Angle	201°·5	203°·5	204°	204°·2	205°·4	203°·7

Summary Table. Mean Date	1888·71	}	Total No. of Observations 25.
„ Distance	16″·71		
„ Posn. Angle	203°·7		

I also give for comparison, measures taken with the *Filar* Micrometer, from 19th March to 26th May, 1888; and from 19th September to 21st November, 1888:—

			Mean of both Columns.
Mean Date	1888·35	1888·82	1888·58
„ Distance	16″·45	17″·10	16″·77
„ Position Angle	203°·34	204·6	203°·97
Total No. of Observa$^{\text{ns}}$	14	29	43

I reckon the variation at the present time at + 1″·00 per annum for distance, and + 0°·7 for position angle. To the foregoing means of measures up to epoch 1889·00, we shall have to multiply these rates of variation by (1889 − 1888·71 =) 0·29:—and (1889 − 1888·58 =) 0·42 respectively. Applying the corrections thus obtained, we may make the following comparisons. In the third column I give the corresponding figures from my Ephemeris—(Society's Vol., 1887, page 82):—

EPOCH, 1889·00.

Micrometer	ABB	Filar	Ephemeris
Distance	17″·00	17″·19	17″·00
Position Angle	203°·90	204°·26	202°·90

I think it probable that the Ephemeris is in error about 1 degree in Position Angle.

The measures of distance by the Filar were all taken as differences of Declination, and were reduced to direct distance by the secant of the Position Angle.

The specially favourable conditions which this star affords for double star observations, as well as the particular interest which attaches to it on many accounts, especially to us in the South, will, I trust, be sufficient excuse for my having dealt with so much detail.

NOTES ON CHARTS OF THE COAST OF TASMANIA, OBTAINED FROM THE HYDROGRAPHICAL DEPARTMENT, PARIS, AND COPIED BY PERMISSION OF THE FRENCH GOVERNMENT.

By A. Mault.

(Charts I, II, III, IV.)

More than a year ago Mr. McClymont spoke to me of the charts of which copies are attached to this paper. He explained at the last meeting of the Royal Society the manner in which he had become acquainted with their existence. I am sorry that it has not fallen to his lot to formally present them to you, for the Society is really indebted to him for their possession. Furthermore, in making the presentation he would have been much more able to accompany the gift with an explanation of the character and history of the charts. Another gentleman to whom thanks are due is my friend Monsieur Adelphe Patricot, of St. James's, Paris, who, after some little difficulty, overcame the prejudice that the French authorities have to allowing plans and maps to be copied, and then insisted on taking upon himself the cost of having fac-simile tracings made. Acknowledgments are also due to the Hon. E. N. C. Braddon, who, when Minister of Lands and Works, authorised the reproduction of the charts at the Government Photo-lithographic Establishment.

Charts of Marion's Expedition, 1772.

The two charts that are respectively called (1), *Côte des Terres de Diemen parcourues en Mars* 1772 *par la flute du Roy le Mascarin*, and (2), *Terres de Diëmen faisant partie de la Nouvelle Hollande la plus grande Isle connüe levé du bord du Vau le Marquis de Castries en faisant route le long de la cote. Par Mr. du Clesmeur*, are particularly interesting. It will be remembered that the first visitors to land in Tasmania after Tasman's time were the French in these vessels. The expedition carried out in them was undertaken at the cost of Captain Marion du Fresne, whose grade in the French Navy was "Captain of fire-ship." The authorities of Mauritius allowed him to charter two of the Government vessels in the Colonial Service, the storeship *Le Mascarin*, the tonnage of which is not given, and the *Marquis de Castries*, apparently a smaller vessel, and to man them at his own pleasure. He himself took command on board the

Mascarin, with Mons. Crozet, who also was Capitaine de brulot, as his second on board, and gave the command of the *Marquis de Castries* to the Chevalier du Clesmeur, who was second in command of the expedition, and succeeded to the entire command on the death of Marion.

An account of the expedition, under the title " New Voyage to the South Sea," was published in Paris in 1783, being compiled from the plans and journals of Crozet. Crozet ignores as much as possible Captain du Clesmeur, who evidently knew it, and also of the proposed publication of the journal. For the editor of the journal prefixes to it a " preliminary discourse," the reading of which, he says, " is indispensable to rectify some important points in the narrative of the voyage ; " and in which he declares that it was only on the eve of publication that he learnt that du Clesmeur succeeded to the command on the death of Marion. For in the journal Crozet never once mentions du Clesmeur's name, from the time of Marion's massacre until the moment when the vessels are parting company at Manilla, but always—even in relation to matters on board the *Castries*—says, " I did this," " I ordered that," as if he were in supreme command. The editor of the journal therefore requests the reader to note that everything done after Marion's death was done under the command of du Clesmeur and not of Crozet.

It is necessary to note this jealousy, as it explains some of the events that came to pass, and some of the results of the expedition. Its main object was to seek the great south land. Marion left the Mauritius in October 1771, and after some detention at Bourbon, Madagascar, and the Cape of Good Hope, left this last on the 28th December in that year. On the 19th January, 1772, he discovered, after having looked for Losier-Bouvet's Cap de la Circoncision in the wrong place,—the islands now called Prince Edward's or Marion's, but which he himself named Terre d' Espérance. While examining the islands, the *Mascarin*, by disregarding the then acknowledged "rules of the road," ran foul of the *Castries*, which was lying to, and carried away her bowsprit and foremast. Crozet, who mentions the accident, carefully avoids details as to cause. Jury masts were rigged up, and it seems that the *Castries* after the accident was still a better sailor than her consort, and du Clesmeur told Marion he was ready to go wherever he wished. But Crozet says that the condition of the *Castries* prevented Marion from carrying out his intention of going southward. Sailing eastward, the islands now called the Crozets were discovered on the 22nd January,—they were first sighted from du Clesmeur's ship,—but like other injustices in nomenclature, record the name of a man to whom none of the credit of their discovery is due.

Leaving the Crozets the ships were steered due eastward until they passed the longitude of St. Paul's Island, and then were headed towards the land discovered by Tasman. This was first sighted on the 3rd March, when Crozet calculated that they were in latitude 42deg. 56min. south. The longitude as given in the "New Voyage" is so evidently incorrect—126deg. 20min. east of Paris—that I will not here allude to it but to say that it certainly is a misprint.

Crozet gives no account of the voyage round the south end of the island, simply saying:—"The chart that I have prepared of the Terres de Diémen will give an exact idea of the configuration of these lands, and of the route we followed till we anchored in a bay named by Abel Tasman, Frederic Henry's Bay, which, according to that naviagator, is situated in 43deg. 10min. of south latitude." The chart thus referred to is given in the "New Voyage" on a very small scale—the whole south coast of the island being shown in a space of less than two inches, and no latitude or longitude is marked. Flinders, in the introduction of his "Voyage to Terra Australis," says of it:—"The chart of Mons. Crozet, which accompanies the voyage, appears, though on a very small scale, to possess a considerable degree of exactness in the form of the land. The wide opening called Storm Bay is distinctly marked; as is another bay to the westward with several small islands in it, the easternmost of which are the *Boreel's Eylanden* of Tasman."

A very cursory examination of this small engraved chart will show that it is a reduction made from the first of the charts mentioned above, and this leaves no room for doubting that the manuscript chart copied at Paris is the original one prepared by Crozet himself on the *Mascarin* and during its passage along the coast. The track of the course made is given, with soundings and with the position of the ship at various hours every day during the passage. These details enable us to correct an error into which Flinders has fallen. He says, after mentioning the sighting of land on the 3rd March, 1772:—"Steering eastward round all the rocks and islets lying off the south coast, he arrived on the evening of the 4th in Frederik Hendrik's Bay." Flinders obtained this second date by deducting the six days Marion is said to have stayed in the bay from the date—the 10th March—when he quitted it for New Zealand. But the "New Voyage" is so full of misprints in figures that it is not to be depended upon without checking. This chart of Crozet's affords such a check. From it, it is evident that after sighting land, Marion in the *Mascarin*, steering south-east, arrived south of the Mewstone about 6 o'clock in the evening of the 3rd March. He probably lay to for the night, but by 5 o'clock on the morning of the 4th he had drifted down to 44deg. of south latitude off South-east Cape. Then steering north-east, at midday he was south of Tasman's Head, and passed the night off Storm Bay. He doubled Tasman's Island at 8 o'clock on the morning of the 5th,—at noon was off the Yellow Bluff, and must have anchored in Frederik Hendrik Bay, now called Marion Bay, early in the afternoon.

I do not think that Flinders, if he had seen Crozet's chart on this larger scale, would have expressed the flattering opinion above given as to its exactness in the form of the land. The longitudes given on this chart and in the "New Voyage" are so far out as to be inexplicable. On the chart the longitude of the anchorage is given as 141deg. 30min. east of Paris—this probably being the result of reckoning and observation during the voyage. At the anchorage Crozet says, "I made several observations for longitude and I found it to be 143deg. east of Paris." This is more than 2½deg. out! In the simpler matter of latitude he is also wrong, giving quite a false impression of the trend of the south coast by making South-west Cape more southerly than South-east Cape.

But it is in comparing this chart with the one made at the same time, and in similar circumstances by du Clesmeur on board the *Castries*, that the work of Crozet most shows its inferiority. From the tracks laid down on the respective charts, and from the soundings given, it is evident that in sailing down the west coast the *Mascarin* was the nearer in shore. Crozet could therefore see the opening into Port Davey, which du Clesmeur could not. This, and perhaps the entrance to D'Entrecasteaux Channel, are the only points in which the *Mascarin* chart is superior to the *Castries* one.

From du Clesmeur's chart it is evident that the *Castries* had, as usual, outsailed the *Mascarin*, for she had to lie to to allow Marion to come up. The rocks and high land near Mainwaring Cove were, in the distance, taken to be islands. Rocky Point is distinctly and accurately laid down. The De Witt range and the hills on Point St. Vincent which mask the entrance to Port Davey were mistaken for islands, the lower land between them not being seen. If the coast-line be carried along the west side of these mistaken islands and carried back along the eastern side, Point St. Vincent and the entrance to Port Davey will be more accurately shown than on Crozet's chart. All the salient points of the south coast, from the South-west Cape to Tasman's Head, are accurately given with the islands lying off. The far end of the bays and bights, not being seen, are less accurately shown. In Storm Bay and eastward and northward to the anchorage in Frederik Hendrik or Marion Bay, the *Castries* went further in, and along this part of the course the chart is wonderfully accurate—in fact in some places more accurate than Flinders'.

It is not often that one has a chance of comparing the impressions made by the same coast-line, seen at the same time, and in almost identical circumstances, by two navigators of the same nation and of equal standing. The result of the comparison in this case makes us regret that the recording of the whole of Marion's expedition had not fallen to the lot of du Clesmeur instead of Crozet. One more word and I have done with this part of my subject. What is now called Maria Island, Marion named St. Mary's Isle. Could not the proper name be reverted to?

CHART OF CAPTAIN HAYES' DISCOVERIES.

Mr. J. B. Walker has recently called your attention to the sole expedition for discovery sent under the auspices of the East India Company into these seas—that commanded by Captain, afterwards Sir John Hayes, who visited the Derwent in 1794. Mr. Walker further told you how "the vessel carrying Hayes' charts and papers to England was captured by the French, and all his journals taken to Paris, and the result of his voyage was lost." I think this is rather too sweeping an assertion, for it is evident from the narrative of Flinders that "sketches" of Hayes' charts were known, and that Hayes' nomenclature of localities was in many cases adopted. I think it probable that the originals or copies of these charts were kept in the Marine Office at Calcutta, and it was from these that the chart published by Arrowsmith in 1798 was taken. It is a copy of this chart (3) that I now present to you.

As for the history of this copy I think that probably it is as follows:—It is entitled, *Chart of Several Harbours in the South East part of Van Dieman's Land. London: Published January 1st, 1798, By A. Arrowsmith, Rathbone Place.* Though it is said to be "published," the copy in the French archives, from which this copy I have was traced, is in manuscript and is kept with the next chart I have to describe, that is, one of Flinders'. In the "Observations" on this latter chart, Flinders says:—"The details of the south-east part of Van Diemen's Land are taken from a manuscript plan made by Mr. J. Hayes who visited that part in a ship called the *Duke* sent out from Bengal. Henshaw's Bay and Cape Hanson of his chart are Frederic Henry Bay and Cape Pillar, of which we have restored the names," etc. Now the parts of D'Entrecasteaux Channel not seen by Flinders are exactly reproduced by him in his chart as they are laid down in this published chart, but the names mentioned by him are different. I would therefore venture to suggest that Flinders, when at home in the winter of 1800-1801, obtained a copy of Hayes' published chart, which was not identical with the manuscript one he had before seen, and that it was found among his papers when they were taken from him in the

Mauritius; that the draughtsman who copied Flinder's chart, that I am about to describe, seeing the reference therein to Hayes' chart, copied the published one as giving further details about the country that was evidently then claiming much attention from the French, and that it was thus that a manuscript copy of an engraved chart found its way into the Hydrographical Office at Paris.

This copy of Hayes' chart is furthermore interesting in connection with the history of names of places in these parts. For instance, it is curious to note how Ray-Taylor's Bay has become Great Taylor's Bay. And the name, "Admiral D'Entrecasteaux Bay" shows that Hayes had heard of the French navigator's voyage.

I may mention that one of our fellow-members, Colonel Cruickshank, is a great-grandson of Sir John Hayes, and have pleasure in adding that he has promised to obtain, if possible, copies of all documents relating to the expedition that may exist among the family papers in England, or in the Marine Office, Calcutta.

CHART OF FLINDERS' AND BASS' DISCOVERIES.

The last of the charts (4) I have to describe is one of exceptional interest. It is entitled, *Carte du Détroit de Basse entre la Nouvelle Galles Meridionale et la Terre de Diemen Levée par M. Flinders, Lieutenant du Vaisseau Anglais la Reliance, par ordre de M. le Gouverneur Hunter en* 1798 *et* 1799." Notwithstanding the title, it embraces the whole island of Tasmania, and there are laid down on it the tracks made in the following voyages:—

1. Bass' voyage in the whaleboat from Sydney to Western Port in 1797-8, whereby the existence of a strait between Australia and Van Diemen's Land was virtually proved. I am not aware of the existence of any other chart showing this track.
2. Flinders' voyage in the schooner *Francis* from Sydney to Furneaux Islands in 1798.
3. Flinders' and Bass' voyage in the sloop *Norfolk* round the Island of Van Diemen's Land in 1798-9. In the chart, the Frenchman who was stealing Flinders' observations has called this sloop the "*Jackson,*" in specifying the routes, confusing the name of the little vessel with that of the port from which she sailed. He calls her by her right name elsewhere. He frequently mistakes English manuscript figures, especially a long drawn 1 for the long drawn French 5, the 3 for the 5 also, and the 6 for the 8.

The longitudes on the chart are taken from the meridian of Paris. The following "Observations" are made:—"The voyage of M. Flinders, second Lieutenant of the English ship, the

Reliance, round Van Diemen's Land, was made in the colonial sloop *Norfolk* of Port Jackson. The position of Port Dalrymple is fixed by 6 sets of lunar distances, taken in each direction with 2 sextants. The rest of the northern and western coast have been traced by estimates corrected by observations along the coast; but on arriving at South-west Cape our longitude, compared with that deduced from Cook's observations, was only 3min. in error. This error seemed to us so small that we changed nothing in the chart we had made. Adventure Bay is copied from the plan of Captain Cook (8th Edition, Dublin), Swilly Rock or Pedra Blanca is placed 59min. of longitude to the east of South-west Cape, according to the table in Cook's voyage, which agreed with the observations we made. The east coast, where shown by a simple line without shading, is traced from Captain Furneaux, and copied from a chart of New South Wales, of which the scale was about an inch to the degree of longitude. The shaded part of the coast in the neighbourhood of Oyster Bay is copied from a plan of 7in. to the deg. made by J. H. Cox and published by Mr. Dalrymple in 1791. The details of the south-east part of Van Diemen's Land are taken from a manuscript plan made by Mr. J. Hayes, who visited that part in a ship called the *Duke*, sent out from Bengal. We cannot answer for their exactitude. Henshaw's Bay and Cape Hanson of his chart are Frederic Henry Bay and Cape Pillar, of which we have restored the names in this: we have also made some slight changes in the names of points surveyed from the sloop: the ports and bays of his chart were called coves, and the rivers creeks.

"The coast of New South Wales from Port Jackson to Western Port was surveyed by Mr. Bass in a whaleboat. The shaded parts are copied from a sketch he made of it by sight. The cape called Ram's Head having been placed in the position fixed by Cook and taken as a datum point, the long coast beyond it has been extended further than shown in the sketch, in order to place Cape Wilson in the position it ought to have relatively to Furneaux Islands. Little confidence can be placed in estimates of courses made in waters like these, where there are strong currents, and it is only by estimate that these points have been fixed. The islands were placed by Captain Furneaux eastward of their real position: they have been marked here after the observations made at Port Dalrymple and the estimated course from that Port to the Swan Islands.

"The beginning and end of an eclipse of the moon, observed at the east end of Preservation Island, gave 148deg. 37min. 30sec. of east longitude from Greenwich, 148deg. (146deg.) 17min. 30sec. east of Paris."

Then follow the symbols giving the various routes; after which the "Observations" continue:—"The double arrows show the direction of the tides.

"In the River Derwent, high water at 8 hours. Height above low water 4 or 5 feet. These tides are feeble, and do not appear to always coincide with full and new moon. Sometimes they have an opposite course. We have grounds for suspecting an under-current in a contrary direction."

What is the history of this chart?

You will remember that when Flinders was kept prisoner in the Mauritius his books, charts and papers were taken from him. After many reclamations most of them were returned to him in the seventh or eighth month of his captivity. In recording this he says:—"Word had been sent me privately that *the trunk had been opened and copies taken of the charts*—(the italics are Flinders') but to judge from appearances this was not true; and on putting the question to Colonel Monistrol, whether the trunk or papers had been disturbed, he answered by an unqualified negative." No one who knows Colonel Monistrol from Flinders' graphic narrative will doubt the Colonel for a moment. But no one who knows from the same source the Governor of the colony, General De Caen, will hesitate for a moment in thinking that he was capable of tampering with the charts, and that if he did so he would take good care that the honest Colonel should not know it. My own opinion is that the private letter was right—the trunk had been opened, and the charts copied—and the manuscript from which this photo-lithograph was taken is one of the copies. I think this is capable of as much demonstration as is possible in such a matter.

Apart from the fact that other information was sent to Europe about Flinders' voyages that could only have been obtained from Flinders' papers—for instance, that which he refers to as having been given in the *Moniteur* of July 7th, 1804—which shows that the papers had been read and a *précis* made or copies taken, there is a great deal of internal evidence that the copy of this chart was made during the time of Flinders' detention in the Mauritius.

In the first place this chart contains exactly all that Flinders knew of Van Diemen's Land at that time—no more and no less. It is true that some of Flinders' charts had been published in England after the return of the *Reliance* in the end of 1800, but it is hardly likely that they were so published till after Flinders had left England in the *Investigator* in May, 1801. I have not seen one of these published charts, but think that they were not precisely similar to this, seeing that Flinders, in his published charts, puts in only his own course, whereas in this he marks Bass' whaleboat track. Again, if this copy were not taken from Flinders' papers, why was it taken at all? If the published chart was in French hands there was no need to copy it in manuscript.

Then there is some internal evidence. In the "Observations" above given the French copyist begins in the third person, but at the end of the first sentence incontinently drops it, and evidently translates exactly what is before him. This greatly differs from Flinders' style when relating any of his own proceedings only, for he always uses the first person singular. I think, therefore, that the "we" used here shows that these "Observations" were written while Bass was still with him, and before Bass had made any separate report to the Port Jackson authorities.

Again, when Flinders was surveying Frederic Henry Bay he had not seen any charts or details of D'Entrecasteaux's expedition, and consequently it is quite natural for him then to copy from Hayes' chart and make the observation above quoted. But when in England in 1800 he could have obtained details of the French discoveries, and would hardly have published the less accurate work. In his great atlas he unhesitatingly prefers D'Entrecasteaux, and dismisses Hayes with rather scant courtesy.

As for the object for which the chart was copied it was probably in connection with some designs of the French colonial authorities in regard to the occupation of Van Diemen's Land. General De Caen no doubt fully shared in the desire to extend French territory in this direction, and thought that all information regarding the island, and especially the south-east part of it, would be useful. If he knew of the beginning made of English occupation, he was not the sort of man to be turned from his purpose by such an act. It may hereafter be found that the real explanation of Flinders' unjustifiable and otherwise inexplicable detention at the Mauritius was connected with De Caen's suggestions to the French Government of an occupation of Van Diemen's Land. No doubt it was thought that the changing of English into French longitudes would facilitate the comprehension of the chart in Paris. It would be easily done by ruling the parallels 2deg. 20min. east of those given on the original. It is pleasant to note that the copy contains no trace of a desire to rob Flinders of the credit of his discoveries.

But the chart taken by itself is very interesting as showing what was known of our island at the moment of its first occupation by our countrymen, and as such I have great pleasure in presenting it to you. The concluding paragraph of the "Observations" shows how careful an observer Flinders was, and contains a suggestion in regard to the anomalous character of the tides in the Derwent that may be of great use, and which I will not forget.

DISCUSSION.

MR. J. R. McCLYMONT complimented Mr. Mault on the careful study he had made of these charts. Their friends in Canada had set them an example in this department of work. The Royal Society there published from time to time historical researches, largely regarding the early exploration of their noble Gulf of St. Lawrence. The Canadians had to go back 350 years; as we stood much nearer the origins of our history than they did, it would be a crying disgrace to us if we allowed them to out-distance us, and if we sluggishly left to our descendants historical work that could better and more easily be undertaken to-day. He referred especially to the discovery and exploration of the Derwent and its approaches, and hoped that Mr. Mault, or some other equally competent person would take the matter up thoroughly, and he, for one, would be most happy to render all the assistance in his power. They had a glorious heritage in this river, with its maze of bay and island, strait and peninsula, wrought out of the blue incandescence of a summer sea. This intricate net had involved one navigator after another; to bring order out of the confusion by tracing the development of our completed knowledge of it would be an admirable intellectual exercise.

The voyages of Kerguelen and Marion du Fresne, were historically connected with those of Bouvet de Lozier and Bougainville, and Marion's later discoveries were the confirmation of those of Tasman. The voyage of Bouvet, in turn, was undertaken for the French East India Company for the purpose of discovering in the Southern Ocean a port for their outward-bound vessels—an idea that was suggested to the minds of these merchants by an imperfect record of the voyage of Gonneville in 1503-1505. The tradition in France was, that this merchant of Honfleur had been cast upon a fertile continent and amongst a race of genial pagans when, after rounding the Cape of Good Hope, he had encountered a violent tempest which drove him out of his course to India. The tradition has been traced as far back as the year 1658, when the Abbé Binot-Paulmier de Gonneville—a descendant from the union of a native of the land on which Gonneville was cast with a relation of the navigator—addressed a memoir to the Pope begging that a mission might be sent to the land of his origin. Whether the Abbé merely adopted a current tradition regarding the discovery of his ancestor, or himself misinterpreted the account of the voyage as given in a judicial declaration signed by Gonneville and his officers, we cannot tell. At all events he placed the discovery south of the Cape, and identified the land so fortuitously found with the legendary *Terra Australis*. Bouvet's attempt to follow the course taken by Gonneville led to his discovery, on the 1st

January, 1739, of the *Cap de la Circoncision*, in 55 deg. S., 5 deg. E. The extreme rigour of its climate was incompatible with Gonneville's account of the country visited by him. Despite much difference of opinion as to Gonneville's actual landfall, some placing it in Virginia, others in South America, and others in the lately coasted New Holland, two fresh attempts were made with the object, not only of finding some compensation for the loss to France of its American territory, but also to discover the southern land supposed to lie near the route to India. These voyages were undertaken by the captain Kerguelen de Tremarec, and were as fruitless as that of Bouvet, for they only resulted in the discovery of the barren Kerguelen Land, in 49 deg. 3 min. S., 68 deg. 18 min. E. Kerguelen returned full of the persuasion that Madagascar was the Southern Indies of Gonneville. When Kerguelen's crews were freezing on the shores of his new antarctic island, Marion was altering his course from an easterly one between the parallels of 46 deg. and 47 deg. S., to one with sufficient southing in it to fetch his ships off the west coast of this island, somewhere between Port Davey and Macquarie Harbour. He too had been disappointed in the weary search for a southern continent, and had only added the Prince Edward and Crozet groups to our cognizance of the Southern Ocean.

The interest of Marion's voyage lies in this—that it was the last French voyage ostensibly undertaken with the object of discovering the *Terra Australis*, and with it and the contemporary voyages of Cook the belief in the existence of a continent reaching as far north as 45 deg. or 50 deg. S, may be said to expire. But this was not Marion's own opinion or the opinion of his officers. On the contrary, Crozet says expressly, "At that point where we then were," namely, Possession Island, "everything promised the discovery of the southern continent could we only have continued to the S.E., but, unfortunately, the state of the *Castries* since she had lost her masts (through a collision), did not permit M. Marion to follow in its full extent the careful project he had formed for the discovery of these lands." *Nouveau voyage*, p. 23. Rochon, editor of the journals of Crozet who was lieutenant on the *Mascarin*, does not agree with the opinion that the change of route was due to the accident to the *Castries*, for he says that its commander, M. Duclesmeur, "assured M. Marion so often and so positively of his ability and willingness to follow his leader that M. Marion must have had some other reason for abandoning his original plan than that above assigned." As for Marion's place in relation to his successors, it is this. Our complete cognition of any portion of the earth's surface is generally preceded by a careful hydrographical survey, and that again by a cursory one, which has confirmed the original discovery. Thus, in Tasmania, the labours of Hayes and Flinders, of Baudin and D'Entrecasteaux, had their *raison d'être* for the English, in the flying visits of Furneaux and Cook, for the French, in that of Marion, whilst in turn Marion, Furneaux, and Cook, were the men who established the indications given by Tasman. Marion is in an intermediate position. He looks back 130 years and—his own plan of original discovery having failed because it was based on insufficiently digested data—he is obliged to be satisfied with the secondary but still honourable and necessary position of the man who confirms another's effort and renders it possible for that effort to flower into scientific achievement.

The islets in the Southern Ocean discovered by Bouvet, Kerguelen, and Marion, may be regarded as so many stepping stones to Australia. To Tasman, who held a more northerly course than the French captains did, the stepping stones were the islets of St. Paul and Amsterdam. To the French captains, they were the *Cap de la Circoncision*, Prince Edward and Crozet groups, and Kerguelen Land, the last three being discovered within a month of each other. Their dates are Prince Edward's Island, January 13; Crozets, January 24; Kerguelen Land, February 13, 1772. Sixteen days out from the Cape the first land was sighted by Marion, and named *Terre d'Espérance*, "because its discovery flattered us with the hope of finding the southern continent which we sought." Cook re-named it Prince Edward's Island, after the Duke of Kent, the father of Her present Majesty. Its mountains were visible at a distance of twelve miles, and were covered with snow. Marion was unable to land and explore it because of the accident to the *Castries*, which happened when the ships were about to take soundings preparatory to casting anchor. A smaller island was seen to the N.E. of the larger one; on its N.E. side, according to Crozet's account, or on its east side, following Ross, is a bay with a large cave; round the cave were a number of white flecks like a flock of sheep, perhaps patches of moss, which Moseley describes as forming principal features in the vegetation of Marion Island as seen from a distance. Had the weather permitted, they would have found an anchorage in this bay which was frequented by sealers at a later date. The island was seven or eight miles in circumference. Crozet places these islands in 46 deg. 45 min. S., and 34 deg. 31 min. E. of Paris; Crozier, the companion of Ross, places the North Cape of Prince Edward's Island in 46 deg. 53 min. S., and 37 deg. 33 min. E. of Greenwich, and Cave Bay in the *Ile de la Caverne* of Marion, is reported by Ross to lie in 46 deg. 40 min. S. There is a discrepancy in the nomenclature of these islands: Ross calls the larger island, which it may be presumed is

Marion's *Terre d' Espérance*, Prince Edward's Island, and gives no name to the smaller island; his reference to the cave on it identifies it with Marion's *Ile de la Caverne.* Moseley of the *Challenger*, on the contrary, says that the Prince Edward group consists of Marion and Prince Edward Islands, of which Marion Island is the larger, and contains 80 square miles. Authorities on the Prince Edward and Crozet groups are C. M. Goodridge's *Narrative of a Voyage to the South Seas.* Lond., 1883; Capt. Lindesay Brine's *Visit to the Crozets*, in Geogr. Mag., Oct., 1877, and the accounts of the *Challenger* expedition.

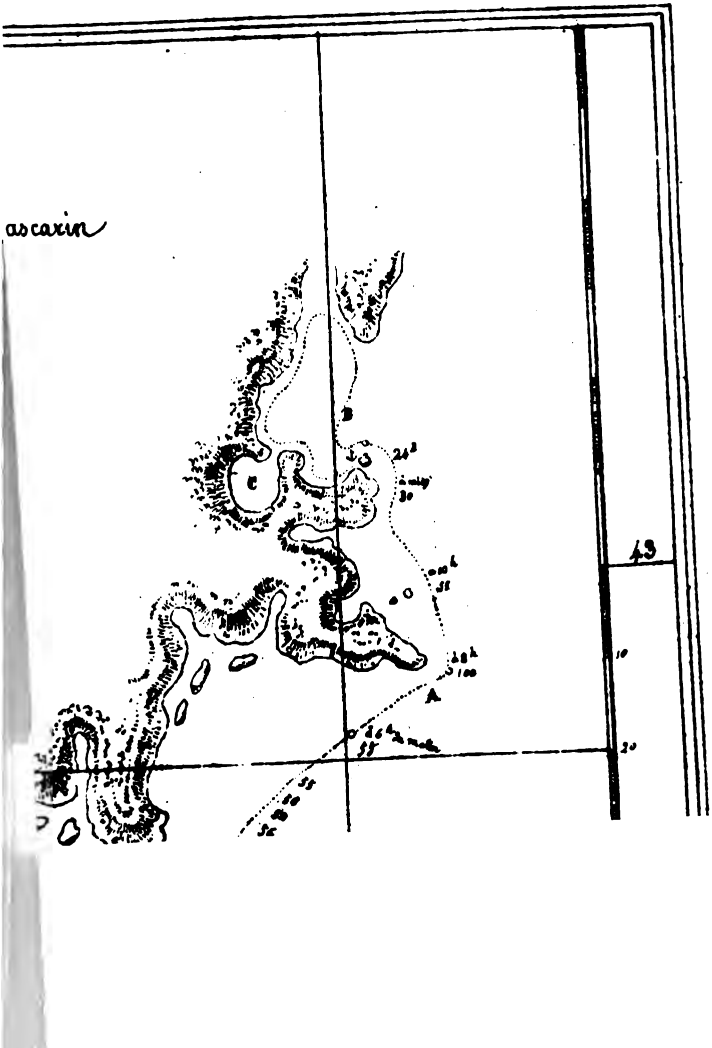
On the sixth day after leaving the *Terre d' Espérance* Marion sighted two other islets in 46 deg. 5 min. S., and 42 deg. E. of Paris by dead reckoning, and named them *Les Iles Froides.* They are the Penguin and Hog Islands of the Crozet group. On the morning of the following day (January 23), they were no longer visible; but Possession Island—*Ile de la prise de possession*—was sighted from the *Castries*, and next day both Possession Island and East Island, the *Ile Aride* of Marion, about ten miles apart, were in sight; the former is placed in 46 deg. 30 min. S., and 43 deg. E. of Paris; Ross places its southernmost point in 46 deg. 28 min. S., its northernmost in 46 deg. 19 min. S., and gives the longitude of these points as 51 deg. 53 min. E., and 51 deg. 56 min. E. respectively.

When the ships were lying off Possession Island, Crozet was sent ashore and annexed it in the name of the King of France, and deposited, according to custom, a bottle containing the declaration of annexation on the summit of a pyramid of rocks about 50 feet above sea level. Not a tree or shrub was visible on the island. He mentions only a species of reed (*jonc*) growing along the shores, a small delicate grass (*gramen*), and a plant he calls *ficoïdes.* Penguins, Cape pigeons, cormorants, and other marine birds were so tame as to allow themselves to be taken by hand, and continued to sit on their eggs without apprehension, whilst the seals gambolled undisturbed by the presence of man. Strangest of all, one white pigeon was seen, from which circumstance Crozet supposed that a land producing the food proper to that family could not be far distant. Nothing further of interest occurred till the arrival of the ships in Frederick Henry Bay, on the 5th March, 1772.

MR. J. B. WALKER said that the Society was under great obligations to Mr. Mault for having obtained copies of the interesting maps which he had laid before them, and for his descriptive paper, and also to Mr. McClymont for his criticisms on the sketch charts relating to Marion's expedition. The map of the Southern part of Van Diemen's Land was evidently that of Lieutenant Hayes, though he thought not absolutely identical with "Captain Hayes' sketch," which Flinders mentions as having had with him on his visit to the Derwent, in the *Norfolk*, in 1798. The latter contained some names—such as Risdon Cove,—which did not appear on the map they had now before them. Of the names on this map very few were now in use. Some of them were given in honour of the captain's fellow-officers in the Bombay Marine. Following His Excellency's suggestion at a former meeting, he had searched for further particulars respecting Captain (afterwards Sir John) Hayes, and his expedition in 1794. He had not succeeded, however, in finding more than was contained in Lieutenant Chas. R. Low's "History of the Indian Navy." That work gave a short account of the discovery expedition, and of Hayes' services in the Indian Seas, from which it appeared that he was a most distinguished naval officer. He was afterwards appointed Master Attendant at Calcutta, ranking next to the officer in Supreme Command of the Indian Navy. As they had in Hobart a descendant of Sir John (Colonel Cruickshank, of New Town), he hoped some clue might be found which would lead to the discovery of the lost journals of the expedition. The map of Van Diemen's Land, purporting to be from Flinders, was most probably copied from one of the manuscript charts which were seized in the *Cumberland* at Mauritius. In a tracing made by Mr. Bonwick from Flinders' original chart, the precise phrases occurred which were here translated into French. With respect to Flinders' detention by Governor De Caen, he had observed in a pamphlet containing a summary of the Brabourne Papers, a statement that amongst the despatches carried by the *Cumberland* was one from Governor King, suggesting the possibility of using Port Jackson as a centre from which to attack the French. The writer of the pamphlet suggested that this despatch might have afforded De Caen a pretext for detaining Flinders, as being a violation of the terms of his safe conduct.

MR. MAULT could not give credence to the latter statement, seeing that Captain Flinders had always been regarded by him in the light of a true man, in every sense in which that could be applied, and strictly honourable in every sense of the word, and he could not credit it that he would so ignore the terms upon which he held his passport from Bonaparte. If such papers were found on him he could not have been aware of their contents.

MR. WALKER fully shared Mr. Mault's admiration for Flinders, who was a man wholly incapable of doing a dishonourable action. If he carried such a despatch, it was certain that he was unaware of its nature. It should also be remembered that the *Cumberland* left Port Jackson during the peace of Amiens, and therefore there would have been no impropriety in Flinders carrying despatches.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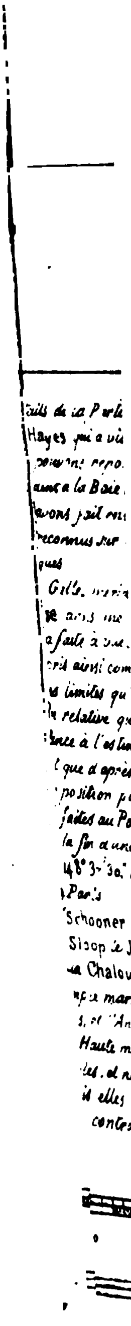

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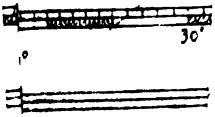

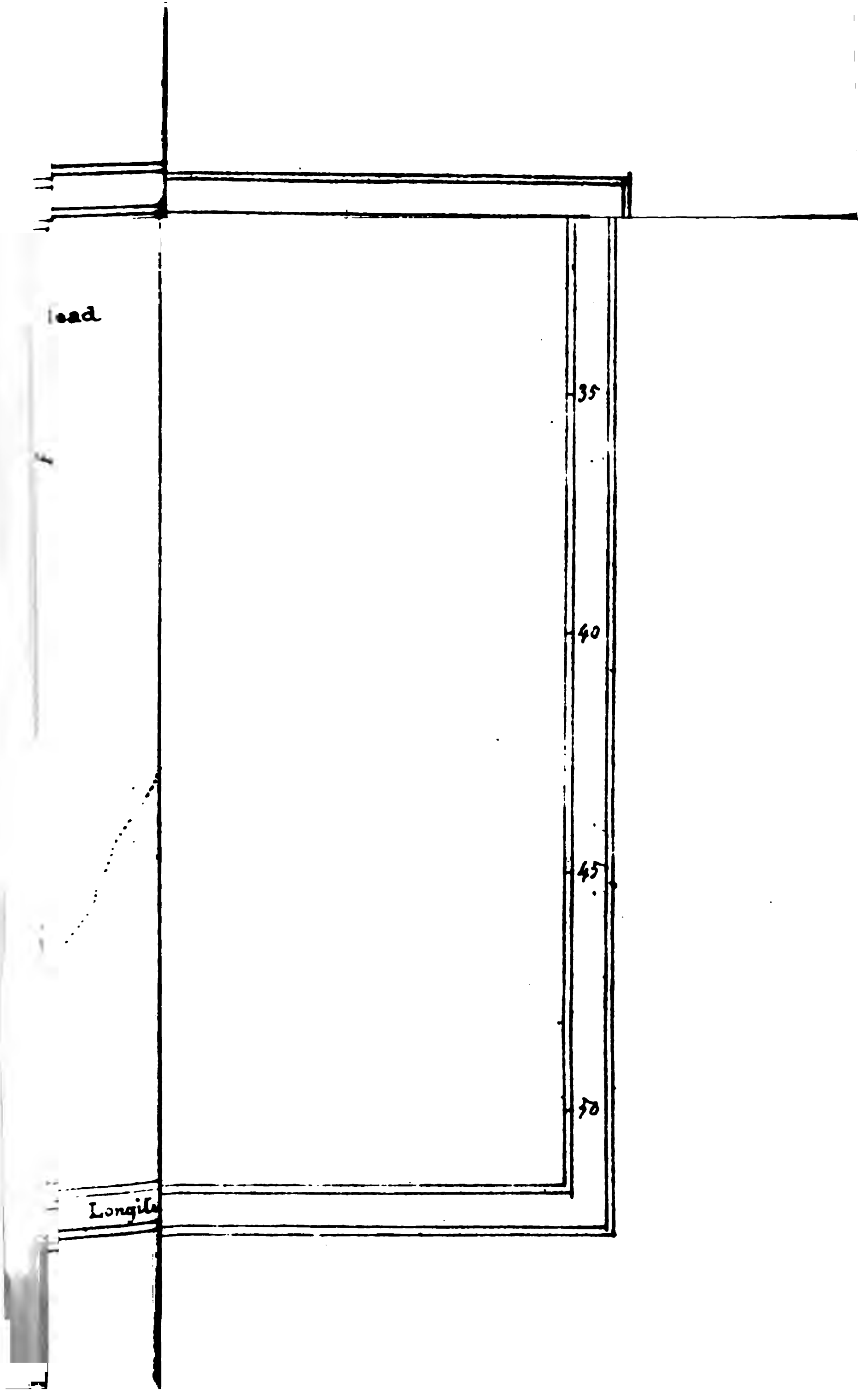
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THE DETENTION OF FLINDERS AT THE MAURITIUS.

By A. Mault.

To the passport dated at Paris the 4 Prairial, An neuf de la Republique Française, to the "corvette *Investigator*, its officers, crew, and effects, during their voyage, to permit them to land at the different ports of the Republic, as well in Europe as in other parts of the world, whether they be forced by bad weather to there seek refuge, or that they come to ask for succour and the means of repairs necessary to continue their voyage," there is added the proviso:—"It is well understood, nevertheless, that they shall not thus find protection and assistance, but in the case that they shall not have willingly turned out of the course they should follow; that they shall not have committed, nor announced their intention to commit, any hostility against the French Republic and its allies; that they shall not have procured, nor sought to procure, any succours to its enemies; and that they shall not have occupied themselves with any kind of commerce nor of contraband." It should be also borne in mind that in the preamble to the passport, Captain Matthew Flinders is named as commanding the *Investigator*. Flinders himself records that the Lords of the Admiralty directed him "to act in all respects towards French ships as if the two countries were not at war; and with respect to the ships and vessels of other powers with which this country is at war, you are to avoid, if possible, having any communication with them; and not to take letters or packets other than such as you may receive from this office, or the office of His Majesty's Secretary of State."

We all know that, the passport notwithstanding, when Flinders and some of his crew—the *Investigator* having been condemned and the *Porpoise* lost—came in the little sloop *Cumberland* to Port Louis in December, 1803, "to ask for succour and the means of repairs necessary to continue their voyage," to use the words of the passport, General De Caen, Governor of the Mauritius, refused the request, and made the captain and crew prisoners of war. Till recently this action of De Caen's has been as universally as righteously condemned. But in 1886, in an official, or quasi-official document, published by the New South Wales Government (a summary of the contents of the Brabourne Papers), the following passages occur:—"Much trouble had been taken to obtain this scientific passport for Flinders. Why, then, was it not respected? We find a satisfactory answer here. . . . Captain Flinders was going home. Governor King took the opportunity of sending home some despatches, and these despatches, there is little doubt, were the cause of all poor Flinders' trouble. We have here (unfortunately, without a date) a memorandum from Captain Kent, of H.M.S. *Buffalo*, for Governor King, in which it is stated that the colony 'is admirably situated for sending forth a squadron against the Spaniards on the coast of Chili and Peru.' Governor King makes this idea the subject of a despatch. He enlarges upon the opportunities this most excellent harbour offers for the concentration of troops, which might at any time be sent against Spanish America. This despatch he entrusts to Captain Flinders, and this Governor De Caen finds when, his suspicion aroused by the peculiar appearance of the little *Cumberland*, he seizes her and detains all her papers. Now Flinders' passport was granted to an officer commanding a ship to be employed on scientific work only, and here Flinders was found conveying a despatch to England, England being at the time engaged in a life and death struggle with France, which, if delivered and acted on, would have the effect of placing points of vantage, and possibly valuable colonies, within easy striking distances. A despatch of this sort could hardly be considered as a document of purely international scientific interest. Governor De Caen did not so consider it, and having a natural animus against all Englishmen, considered himself justified in using the excuse this paper gave him to justify a rigorous imprisonment." And the writer goes on in a rather sneering style about "poor Flinders."

I confess that I have "a natural animus" against special pleading of this sort. If it had to be answered from information given by itself the task would be difficult, for the information given is so vague. The only one of the documents above referred to, which is specifically said to exist among the papers, is the memorandum "unfortunately without a date" from Captain Kent. But Governor King's despatch founded thereupon; is it among the papers? If so, why is it not to be published as Captain Kent's memorandum is? Again, what is the proof that Flinders took this despatch, and that it fell into the hands of De Caen, and when did he use "the excuse this paper gave him to justify a rigorous imprisonment?"

On the contrary there is much to prove that no such despatch was carried by Flinders, and that consequently none such could have been taken from him by De Caen. Flinders did take despatches from King to the Secretary of State in England, and those despatches were taken from him and never returned; but they could not have been of this contraband character, for in almost all certainty they were papers relative to Flinders' expedition, detailing the arrangements the Governor had made, and the orders he had given in consequence of the abandonment of the *Investigator*. This is proved as clearly as such a fact can be by the conduct of both Flinders and De Caen. Flinders would not willingly have taken general despatches, much less such an one as this particular one of Governor King's is described to be, for he would not carry any from the ships at Madeira and the Cape. And he blames the captain of *Le Geographe* for taking some from Mauritius, which, had he been guilty of the same offence, he could hardly have done at the time he was claiming the benefit of his passport on the ground of not having broken its conditions. While the despatches were in De Caen's hands, Flinders writes to Admiral Linois, asking for his intervention, and says :—" I should willingly undergo an examination by the captains of your squadron, and my papers would either prove or disprove my assertions. If it be found that I have committed any act of hostility against the French nation or its allies, my passport will become forfeited, and I expect no favour; but if my conduct hath been altogether consistent with the passport, I hope to be set at liberty, or at least to be sent to France for the decision of the Government." Is it likely Flinders would have challenged this enquiry if he knew that De Caen had written proof that his conduct had not been " consistent with the passport ? "

But it may be said that Governor King may have sent the despatch without letting Flinders know its contents. That is true. But if it had been among Flinders' papers De Caen would have found it, and it is certain, notwithstanding all that the author of the summary of the Brabourne Papers says about De Caen's finding it and acting upon it, he never did find anything of the sort. It was exactly the kind of thing he wanted to find, and had he found it, it would have afforded the only possible justification of De Caen's after conduct, and he would not have been driven to make the paltry excuses he was reduced to. But not finding any such thing he had to fall back on a passage in Flinders' journal, in which, after giving his main reasons for running into Port Louis rather than to the Cape, he adds, as a subordinate one, that it will give him an opportunity of making meteorological and other observations on the Mauritius. If De Caen had the despatch which would have constituted a real proof that the passport had been forfeited, would he have withheld it and put forward the fictitiously hollow reason that by the passport Flinders " was certainly not authorised to put in at the Isle of France to be able to observe the periodic winds, the port, the actual state of the colony, etc., that thus by this conduct he had violated the neutrality under which he had been indirectly permitted to land in this island." Such is the only excuse De Caen offers, not only to Flinders in his captivity, but to the French Government at Paris. For in the *communiqué* of the Government in the Moniteur of the 22 Messidor, An. XII. (11th July, 1804) on the subject of the arrest, detention and falsely reported release of Flinders, it is said:—"In fine, the passport granted to M. Flinders did not admit of any equivocation upon the objects of the expedition for which it was given; but we read in one part of his journal that he suspected the war; and in another, that he had resolved to touch at the Isle of France as well in the hope of selling his vessel advantageously, as from the desire of knowing the present state of that colony, and the utility of which it and its dependencies in Madagascar could be to Port Jackson." Now is this language compatible with the existence of King's despatch among Flinders' papers? If Flinders had carried what was clearly contraband of war, would the French Government have been content with the above lame apology for his arrest? There can be but one answer.

No! De Caen's conduct admits of no palliation. It brands him with everlasting infamy. The finding of King's despatch after he had arrested Flinders, would not much exonerate him. When Baudin came to Sydney was he arrested, and his ship searched for compromising documents to justify the arrest? I am only sorry an Australian should attempt to whitewash De Caen by a method which, if successful, would tarnish the memory of Flinders.

DISCUSSION.

MR. J. B. WALKER said that Mr. Mault had undoubtedly made out a good case, but there was independent evidence to show that Flinders did carry despatches to the Secretary of State. Amongst the State papers in the Record Office, lately copied by Mr. Bonwick for the Tasmanian Government, was a despatch from Governor King to Lord Hobart, dated 8th October, 1808, in which the Governor refers to previous despatches sent by the Cumberland. What was the nature of these despatches did not appear, but they probably related to Flinders' explorations, and were not in any way a violation of the conditions of his safe conduct from the French Government. Mr. Mault's strongest argument—indeed, an unanswerable argument—was, that if these despatches had been of the compromising character suggested by the writer of the pamphlet on the Brabourne Papers, Governor De Caen would have produced them in evidence against Flinders as a complete justification of the detention, and would not have been driven to find a paltry excuse in an entry in Flinders' journal. In any case Flinders' himself was without blame in the matter.

OBSERVATIONS REGARDING PYRAMID NUMBERS.

By R. M. Johnston, F.L.S.

(Diagrams.)

The ancient structures of Egypt, especially the pyramids, have ever been regarded with the most profound interest. Travellers and historians find in them an everlasting theme for description. Geometricians also find in their designs, magnitude and dimensions, much matter for scientific speculations; and the mystic inspired by their age, grandeur, and mystery, is disposed to gather from their every feature some more or less fancifully conceived revelation or miracle.

Nor can we wonder at this. Egypt is the land of wonders. Great pyramids covering acres of land; colossi sitting silent in granite thrones; obelisks of prodigious height wonderfully carved from a single stone; and temples, sphinxes, and canals, of stupendous proportions. When we consider that all these monuments were hoary with age at the time of Herodotus, and that a close study of their works and hieroglyphics reveals that their builders had attained great knowledge in astronomy, geometry, architecture, engineering, and various arts, we may readily admit that our highest modern civilisation was cradled in the land of the Pharaoh's.

It is not my intention, however, to enter into the enquiry of Egyptian civilisation at present. The observations which I have to make are confined to the pyramid structures themselves. It is now well established that pyramidal structures were peculiarly characteristic of the most ancient civilisations of India, Babylon, Nineveh, Egypt, China, North America, Mexico, and even in islands of the Pacific; and that the whole or greater part of them are associated with sepultures for the dead. But while it is most probable that originally such monuments were built solely for commemoration and for the preservation of the remains of noble persons, there are also good reasons for supposing that some of them—such as the Great Pyramid of Gizeh or Cheops—fulfilled a double purpose. The Great Pyramid of Cheops covers a space of about 13·05 acres. If we make allowance for slight disturbance, due to pressure of the enormous superincumbent weight, we must assume that its designer intended its base to form a perfect square, and its shape a true pyramid. The various measurements of the most competent engineers only show a variation of 11, 13, and 19 inches in the length of each side, and with such doubtful data the side has been variously estimated at between 9,129 and 9,164 inches, and the mean of the five most careful measurements give a length of 9,137 inches, or 36,548 inches for the circuit of the four sides. Ferguson's, Dufell's, and Colonel Howard Vyse's measurements of height are the most reliable, and they only vary between 450¾ feet and 456 feet, or 5,472 English inches. Broadly speaking therefore its circuit represents about 100 inches for each day in the year, and its height almost exactly ⅗lbs. of its side base. The orientation or eastward aspect is almost true, being 0 for South-East, + ·1 for North-East, + ·1 for South-West, and + ·0·636 for North-West. Subsequent settlement or earth tremors might easily account for these minute divergences from absolutely true orientation.

While rejecting the many fanciful interpretations of mystical writers drawn from known facts with respect to shape, dimensions, measurements, and orientation, I have long been convinced by the reasoning of sober minded investigators that the principal characteristics were probably determined as a base or fixed standard for measures of space and capacity; and if so, the shape and dimensions themselves might have been suggested to the skilled geometricians of the time by reference to some astronomical fact of importance known to them, in conjunction with significant properties of number and proportion discovered by them to belong to the structure of cubes in pyramidal form. That men who taught the modern world mensuration and astronomy, should strive to attain a sure method for securing uniformity in standards as applied to weights and measurements, is a most reasonable supposition. That these standards should be symbolised by some striking or well-known astronomical fact, is in the highest degree probable, and corresponds exactly with the idea of the French astronomers, who determined the length of their metre in relation to the ascertained length of a meridian line drawn from the Pole to the Equator. (The metre representing the tenth millionth, or 39·37079 English inches; the centimetre being one hundredth of a metre. The gramme or standard of weight is derived from the centimetre, *i.e.*, a cubic centimetre of distilled water at the temperature of maximum density, nearly equal to ·0022054 of an English avoirdupois pound, or 15,438 English grains.)

Impressed with this idea, and with the conviction that the Egyptian builders were adepts in the construction of models, I sought to obtain some light upon these matters by studying the numerical combinations of simple cubes built upon the pyramid type. I was guided to a considerable extent in these investigations by the wide prevalence of multiples of 7, 12, and 10, in the existing subdivisions of time, space, weight and value. How has it come about, for example, that a certain sacredness attaches to the number 7? Why was the important division of the year (a week) determined to be seven days, for it was in common use long before the birth of Moses? Why was the seventh day originally set apart as the Sabbath? Why have we the day divided into two parts of 12 hours each, and why do multiples of 12 so commonly appear in weights and measures, especially in astronomical divisions?

In many combinations conducted with the hope of throwing light on such matters, I failed to get any remarkable indications, with three important exceptions. These three exceptions possess so many remarkable proportions and numbers relating to existing sub-divisions of weights, measures, and values, and especially with the proportions and dimensions of the Great Pyramid, that I have been induced to risk the appellation of "pyramid mystic," and to lay the remarkable results before the members of this Society.

The models which appear before you have each some particular claim to notice, and whether any of them may offer sufficiently remarkable characteristics or not as bearing upon the Great Pyramid, they are all well worthy of close attention as offering a natural solution to the genesis of particular numbers as used in sub-divisions or measures of time, space, weight, or value.

PYRAMID OF ODD NUMBERS, HAVING 7 AS A BASE.

As shown in diagram, the most remarkable characteristic is the fact that the cube root of its basal layer, 49 or 7^2, enters into and agrees with all the important dimensions of the Great Pyramid, including length of complete circuit; length of side; height; length of Egytian cubit; English inch; and through the latter it harmonises in the most obvious and simple multiples with these dimensions and the days in the year, days in the lunar month. Other natural proportions of the three angled sides of pyramid connote the months in the quarter and year; while its aggregate number of cubes, 84 or 7 times 12, suggest the alliance of 7 and 12 in measurement of time.

* * * * *

Demonstration indicating that the Great Pyramid dimensions were probably determined by the radix of sacred number (7), which in itself has probably been selected because the cube root of its square contains nearly the exact figures representing the known days in the year:—

$$\underline{\text{Radix}\,(\sqrt[3]{7^{\cdot 2}}) = \text{R} = 3{\cdot}6593.}$$

1. Circuit of pyramid in inches 36593 = 10000R
2. Length of each side (4) „ „ 9148 = 10000R
3. Height of pyramid „ „ $5488^{\cdot 9} = \dfrac{{}^{3}(10000\text{R})}{2}$
   = $457^{\cdot 9}$ feet

Note.— $\frac{3}{2}$ Height proportion may have been selected because 3 expresses the number of dimensions in a cube: and 1 ÷ 2 exactly expresses the relative elevation surface of a triangle and square resting upon a common base and of equal vertical height at its maximum, in a vertical line drawn at right angles to base line.

4. Principal unit of measurement in inches $25^{\cdot41}$ = $\frac{1000\text{R}}{12^{\cdot2} \text{ or } 144}$
Nearly equal to existing cubit in Egypt.

Note— $12^{\cdot2}$ most probably was adopted as a divisor, because curiously enough the actual number of square cubes contained in a pyramid of even numbers, which most nearly approaches the number of days in a year, is 364, and the base of such pyramid or 1st layer contains 12 × 12 cubes or 144: the second layer in importance succeeds it with 10 × 10 cubes or 100 (see plan).

5. Cubits in circuit of pyramid, No. 1440 $= \frac{1000\text{R}}{12^{2}}$

$$= \frac{10000\text{R}}{10000\text{R} \div 12^{\cdot2}} \text{ or } \frac{10000\text{R}}{25^{\cdot41}}$$

6. Ditto in each side (mean) 360. $\left(\frac{10000\text{R}}{10000\text{R} \div 12^{\cdot2}}\right) \div 4$

7. Unit or year or 1 $= \frac{10000\text{R}}{10000\text{R}}$ or $\frac{\sqrt[3]{7^{\cdot2}}}{\sqrt[3]{7^{\cdot2}}}$

8. Days in Week or 7 $= \frac{7^{\cdot2}}{7}$ or $\frac{49}{7}$

9. Months in Year or 12 = Angles on 4 faces 4 × 3: also equal to base of a simple pyramid of even numbers whose aggregate represents 364: also, the seventh of the aggregate of a simple pyramid of odd having 7 for its base.

10. Lunar Months in year or $13 \cdot ^{3}$ nearly $(13 \cdot ^{37}) = \dfrac{10000R}{7 \times 4}$

SQUARE PYRAMID OF MIXED ODD AND EVEN NUMBERS, HAVING FOR A BASE $(7 \times 2)^2$ OR $14^2 = 196$.

Perhaps this forms the most interesting of all the combinations. Its natural proportions and naturally related numbers are most suggestive.

The following combinations are most striking:—

1. If we take either the exposed cubes on the margin of each layer, or the total faces of distinct cubes in the four sides, the aggregate comes exactly to 365, or the exact number of days in the year; and therefore the proportional number of cubes on each triangular face is 91¼, corresponding to days in the quarter of a year.
2. If we now take the basal layer alone, we find the exposed number of cubes in the square to be 52, corresponding to weeks in the year.
3. If again we take the aggregate of all cubes in the pyramid, we find they amount to 1,015, and if this number be multiplied by 36, or 4 times 9 (the latter number representing the number of verticle angles on faces of the four wedges or prisms of which the pyramid is built, as indicated by its diagonals), we obtain 36,540, or within 8 inches of the best actual measurements of its present state, which has no doubt undergone some slight settlement due to superincumbent pressure.
4. A quarter of this gives 9,135 inches, or within 2 inches of the mean of the best actual measurements obtained by competent investigators.
5. If we now take the square of its basal layer, 14 × 14, we get 196, and it is remarkable that if this number be multiplied successively by half the side, and by the number of sides, *i.e.*, 196 × 7 × 4, we get 5,488, or within 16 inches of the best estimates of the present height of the Great Pyramid, any two of which differ far more seriously with each other than this curious combination.

6. The basal layer has 13 distinct cubes in each side, corresponding to number of weeks in each quarter, which the side typifies naturally; while the three angles of each triangular face makes 12, corresponding with the months in the year or hours in the day.

These combinations are all natural to the particular structure, and are not selected in arbitrary or forced way as in many suggestions found in works referring to the pyramids.

SQUARE PYRAMID OF EVEN NUMBERS HAVING 12 FOR ITS BASE.

The remarkable characteristic of this pyramid is that—

1. The aggregate of all the cubes, if capped with an odd one as a finishing point, numbers 365, corresponding to the number of days in the year. It has 12 cubes along the basal layer of each side, corresponding to months. There are exactly 36 cubes in each triangular face, and 144 in basal layer. If each of these be multiplied by the number of cubes in side of 2nd layer, and taken as divisor of the circuit and side of pyramid they give results which almost exactly correspond with the existing cubit of Egypt.

The same result is very closely attained bp multiplying the aggregate number of cubes (365) by 7, and dividing the result by the square of the second layer (100).

2. But perhaps the more interesting numbers in this pyramid of even numbers are those of the cubes of the exposed sides of squares, and the aggregates of the cubes in each layer.

It is singular that in the first series the sequence 1, 4, 12, 20, should exactly correspond with the sequence of English standards of money value, viz.: Farthing, farthings in penny, pennies in a shilling, and shillings in a pound.

The figures of the base, 12 and 144, are associated with sub-divisions of square measured multiples or subdivisions of 28, as 7, 14, 28, 56, 112, 2,240 as in sub-divisions of weight; and in the second series of aggregates we have in the second layer the numbers 10, 220, and in the basal exposed margin of circuit 44, all suggestive of some connection with reasons which originally entered into the determination of subdivision of 44, 220, 440, 1,760, in the English mile.

CONCLUSION.

Taken by themselves the remarkable coincidences with known facts relating to measurement of time and space might only be construed as simple examples of the facility with which many numbers may be made to coincide with known

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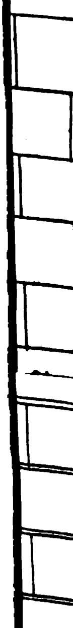

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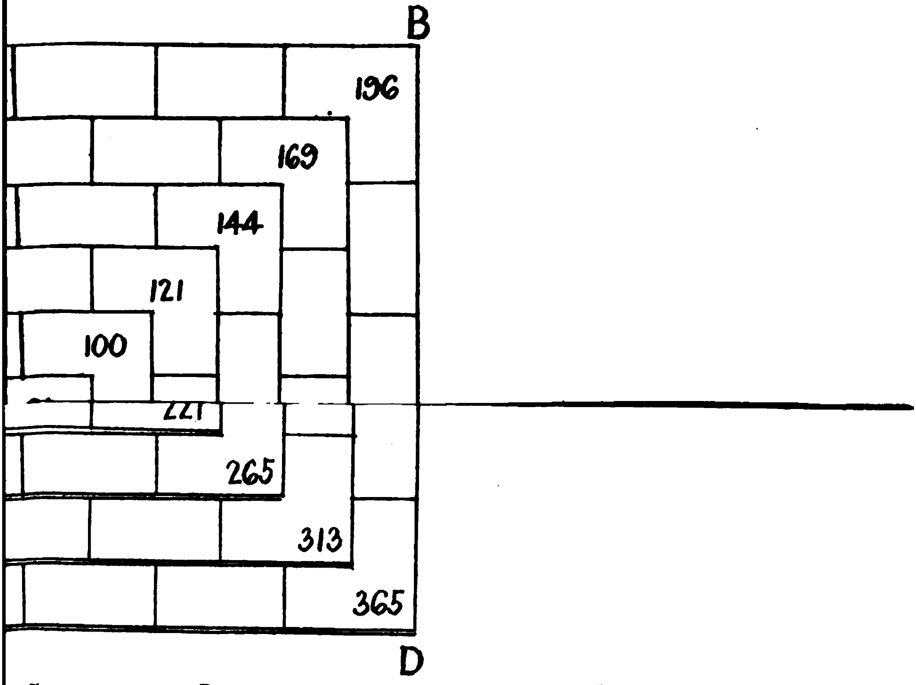

ubes on and above each layer ;[a] Basal = 1015
on each layer ;[a] " = 196
posed on the four vertical faces of each layer ;[a] " = 52
" " " " of all layers ; " = 365
es seen on each of the four faces of each layer ; " = 13
" " " " " " " " all layers ; Aggregate = $91\frac{1}{4}$
" " " " " " " " each layer ; Basal = 14
gles on four faces 4 x 3 = 12
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ng base of each of the four wedges or prisms 7 x 7 = 49
ubes on each " " " " " " = $91\frac{1}{4}$
ramid

measurements or proportionals relating to the earth's diameter, circumference, distance from the sun, annual period of revolution, etc.; for it is easy by slight variations of any root, arbitrarily made, and arbitrarily selected multiples, to make any number approximate to some important terrestrial measurement, provided that the computer is himself previously aware of the proportional, size, or measurement, with which a show of correspondence is desired. Much of the so-called remarkable coincidences of mystical writers are of this class; for it not unfrequently happens that the same root measurement, by slight alteration, is worked up to bring about coincidences with very different things. Thus Mr. Piazzi Smith, by taking the height of the niche of the Queen's Chamber of the Great Pyramid as 182·62, and multiplying it by 2, he obtains 365 242, equivalent to the days in the year; and again by arbitrarily taking the same dimensions as 185, and multiplying it successively by 3·1416 and 10, he obtains 5,812, which he arbitrarily concluded to be the height of the Great Pyramid in inches. But curiously enough the same dimensions, 182·62, multiplied by 10 and divided by 2 (why not at once multiply by $5^{\cdot 2}$) is made to show an approximate to length of one of the sides in inches. These are common examples of the facility with which many fancy the discovery of purposeful design in numbers or dimensions, when dealt with in a fanciful and arbitrary way.

It seems to have been forgotten by such persons that any root figure, by the *arbitrary selection* of a multiplier or divisor, may be made to coincide exactly with any other number *provided the manipulator knows beforehand the number or proportional* with which correspondence is sought to be established.

But making all allowance for the vagaries of the mystics, there are many legitimate subjects of enquiry, upon which some light might be thrown by the careful investigation of ancient structures At the present day it is remarkable how largely the numbers 7, 12, and 10, or simple multiples of these enter into standards of space, time, weight, and value. It is easy to imagine how 10 was seized upon so frequently as a standard of measurement; for counting by means of the digits of the two hands so universal and so natural at once suggests a probable reason; but the reasons for the original selection of 7 and 12 for a similar purpose are not so easily conceived.

What, for example, were the determining causes for the selection of the many sub-divisions of weights, values, time, lineal and square measure?

Why have we a sequence of 4, 12, 20, in English money in sub-divisions of the penny, shilling and pound; of 14, 28, 56, 112, 2,240, in sub-divisions of a ton weight; of 44, 440, 1,760, in sub-divisions of the English mile; of multiples of 12 in square measure; of either 8 or 7 as a root of wine measure?

8 × 1	gall.:	8 × 42 7 × 48	tierce:	8 × 62 7 × 72	hogshead
8 × 84 7 × 96	puncheon:	8 × 126 7 × 144	pipe:	8 × 252 7 × 288	tun

Then going to the survivals of ancient systems of linear measurement, how can we account for the origin of lineal measures, such as—

The English foot ...	Equivalent to	12	English inches
The ancient "Pied de Roi" of France ...	„	12·79	„
The German elle	„	22·58 22·9	„ „
The Italian pié ...	„	22·428	„
The common guerze of Persia	„	25	„
The pio of Turkey ...	„	26·8	„
The braccio of Ancona	„	25·33	„
The short picha of Greece	„	25	„
The long „ „	„	27	„
The existing derah or cubit of Egypt ...	„	25·488	„
Jewish cubits ...	„	25·61 24·74	„

May it not be possible therefore that the ancient draftsmen or modellers of pyramids had seized upon many of these characteristics shown in the forms and figures referred to, both for sub-divisions of measures and weights, and also to typify in their important fixed standards some of the more remarkable facts of astronomy then known to them?

NOTE ON THE AUSTRALIAN CURLEW AND ITS CLOSELY ALLIED CONGENERS.

By Colonel W. V. Legge, R.A., F.Z.S.

A comparison of the Australian Curlew with its near Asiatic ally, and its more distantly related representative in Europe and Western Asia, may not be uninteresting to Members of this Society who study ornithology.

The Curlews of the old world, like other members of the Wader family (*Charadriide*), resemble one another in plumage, and hence we find that a few years ago Naturalists confused them not a little; we have the Indian and the Chinese Curlew spoken of as the European bird, and there seems to be some confusion about the European and South African species. Unlike the American Curlews, which have a distinguishing characteristic on the buff tinting of the under wing and axiliaries, the old world species differ chiefly in character of the markings of the breast and axiliaries and in the ground colour of the rump, and it is by referring to these parts that a correct diagnosis of the above species, on which I make this note, can be founded. A marked characteristic, however, of the Australian bird is its length of bill.

The European or common Curlew is:—Numenius Arquata (Linn), described as *Scolopax Arquata,* Linnæus, Syst. Nat. Ed., 12, 1. p. 242 (1766).

The Eastern, or Asiatic Curlew is :—Numenius Lineatus (Cuvier), Reg. An., 2nd Ed., 1. p. 52 (1829).

The Australian Curlew is :—Numenius Cyanopus (Vieillot), 2nd Ed., du Nouv. Dict. d'Hist. Nat. Vol. viii., p. 306 (1817).

The latter is the Numenius Major of Schelgel from Japan, and the Numenius Australis of Gould from Australia, and likewise the Numenius Rufescens of Gould, in the proceedings of the Zoological Society, 1832, p. 286—which name appears to have been founded on a specimen in breeding plumage.

The following diagnostic table will tend to illustrate the characteristics above alluded to:—

	BREAST.	AXILIARIES.	RUMP.	BILL.
NUMENIUS ARQUATA.	Feathers, with central brown markings broken into the form of bars.	White, more or less *barred* with brown; if the markings are almost absent they still take the form of bars near the tip.	*White*, the feathers striped with dark brown, expanding into bars on the longer tail-coverts.	Along culmen, base to tip ♀ 50 to 65 inches.
NUMENIUS LINEATA.	Feathers, with narrow shaft lines of brown, ground colour, whiter than in *N. Arquata*.	White, with narrow *shaft-lines* of brown, never in the shape of bars.	*White*, tail-coverts with dark brown shaft-lines.	Along culmen, base to tip ♀ 70 to 75 inches.
NUMENIUS CYANOPUS.	Feathers, with bold sharp stripes of dark brown, the white ground colour tinged buff, deeper in summer plumage.	White, *barred* with brown, more clearly than in *N. Arquata*.	*Brown*, like the back, the markings in the form of interrupted bars.	Along culmen, base to tip ♀ 68 to 80 inches.

N.B.—There is another Curlew that has the rump coloured like the back, instead of being white; I refer to the large American species, *N. longirostus*.

As regards our Curlew, N. Cyanopus, on arriving in Tasmania in September some specimens have the buff tinge of the breeding season still remaining on the breast and flanks, and accompanying this is a rufescent hue on the longer upper tail coverts and central tail feathers. This species no doubt varies in size, length of wing and length of bill, as much as its congeners. But, unfortunately, I have not yet got together a series of specimens, and cannot give much information on the subject. A pair shot in Ralph's Bay, by my son, on the 14th September, measured as follows:—

♀ Length, 24·75 in.; wing, 12·25; expanse, 42·0.; tarsus, 3·5; bill along culmen, 6.9. ♂ Length, 22·0 in.; wing, 11·1; tarsus, 3·4; bill along culmen 5·5. In both, the legs were bluish grey, with the toes darkish; iris, very deep brown; bill, dark brown; tip, blackish; base beneath, fleshy reddish.

Geographical Distribution.—Although the Australian Curlew is a migratory species, breeding in northern climates in summer and "wintering" here in *our summer*, many seem to remain throughout the year with us. This is a common feature in the economy of the Waders. I have found several species of well-known "northern breeders" remaining in Ceylon in considerable numbers in the cool season, but not to breed; and though our Curlew remains with us in the winter it is impropable that it breeds here.

It migrates north through the Malay Archipelago, being there met with on passage in Borneo, New Guinea, the Philippines and other islands; thence northward along the coast of China to Amoor Land, and up to Lake Baikal, in which region it is supposed to breed. In Japan, it has been met with as far north as Hakodadi. According to Buller it only occurs sparingly in New Zealand; but nevertheless seems to remain there in winter. New Zealand is probably its eastern limit; for farther east it is replaced by the oceanic species, *N. femoralis*, with curiously formed tibial feathers, and which occurs in the Marquesas Islands. Ramsay records our bird from all the Australian Colonies.

Following the principle advocated here, that the Asiatic Curlew, *N. Lineata*, is distinct from the European bird, we have the range of the former across the continent to China, down the peninsula of India to Ceylon, and likewise southwards from China to the Malay islands, where it has been procured in Java, Sumatra, and Borneo. The same form of bird is known to migrate down the east coast of Africa, and Layard records it as a resident in South Africa.

Its range would appear to be over-lapped, so to speak, by that of the Australian Curlew in Amoor Land and Japan, the present bird not being found north of the south-eastern part of

Mongolia—where it breeds, quitting the southern portions of the continent in April for that purpose.

Lastly, the range of the European Curlew may be defined to extend throughout Europe, taking in the Orkney, Faroe, and Shetland Islands. It likewise occurs in Western Asia. It is found in the Azores and in North Africa, extending down the coast of that continent to Damara Land. It appears not to wander to the extreme south, for all the South African Curlews I examined in the British Museum when compiling my work were inseparable from the foregoing species as found in India, China, and Ceylon. It would therefore appear to take in the west coast, while the Asiatic or "Eastern" Curlew monopolises the east coast and the extreme south in its wanderings.

ADDITIONS TO THE LIST OF TASMANIAN FOSSILS OF UPPER PALÆOZOIC AGE.

By Robert M. Johnston, F.L.S.

(Plate.)

The mudstone beds (Upper Palæozoic) in the neighbourhood of Hobart are extraordinarily rich in spirifers. Fourteen species have already been noted in my recent work on the Geology of Tasmania. A number of other interesting forms have been collected by me during the last two or three years; but hitherto I have not had time to study them with that care which is desirable; for any one who has worked long in our rocks must be aware of the many difficulties which are presented when any attempt is made to determine the characters of the Protean-winged spirifers of Tasmania. In the mudstone rocks *casts* alone are generally found; and although these are numerous and sharply marked, the casts present such a wonderful range of variation when large numbers of the same species are subjected to examination that the task of determining the central or most typical representative of each species is extremely puzzling. If attention were confined to a single specimen—as is often the case where odd specimens are despatched to palæontologists at a distance —there would be less perplexity; but it need hardly be stated determinations so made, without the knowledge of local variability, must add greatly to the perplexities of the field worker who may have to determine whatever variety comes to his hand by the aid of descriptions based upon odd types.

All the winged spirifers of Tasmania are extremely variable. and many species among these extreme forms are scarcely separable from similarly variable allied species. *S. convoluta*, *S, bisculcata*, *S. vespertilio*, *S. duodecimocosta*, and *S. avciula* are remarkable for the extreme variability in form and sculpture. Added to the difficulties of the observant field worker are the variety of modes in which they are presented in casts; some showing sharp details of external surface of right valve; some of left; some of more or less blurred surfaces of one or both sides of internal casts. The greater number, again, are curiously distorted. It is not surprising, therefore, that many able authorities have had frequently to revise the classification of many of these forms, when other examples of an abnormal form or type have been submitted to them. The following six species, as determined by me from a series of specimens of each kind, presented all the difficulties referred to; but after careful comparison I was enabled to account for young and adult forms, and to mark individual variation; and finally I could with some degree of confidence, select the most typical of each group. By this means I have reduced a large number of variable specimens to six species, all of which I have been able, with some degree of confidence, to refer to types of well-known fossils occurring with many of their associates in rocks of the same age in Europe. Fairly good photographs have been taken of these, and the following are the determinations which I have been able to arrive at.

TASMANIAN BRACHIOPODS.

Figs. 1, 4.	Spirifera striata	*Martin*	Huon Road
„ 2, 7.	——— laminosa	*M'Coy*	„
„ 3, 8.	——— cristata *var.* octoplicata	*I de C. Sow.*	„
„ 9, 10, 12.	——— duplicostata		
„ 5, 6.	——— alata	*Schl.*	„
„ 11.	——— triangularis	*Martin*	„
„ 14, 15.	——— vespertilio	*G. Sow.*	„
„ 18.	Leptæna sp.		„
„ 16.	Pachydomus sp.		„
„ 17.	Ditto		
„ 19.	Stenopora ovata	Lons	„

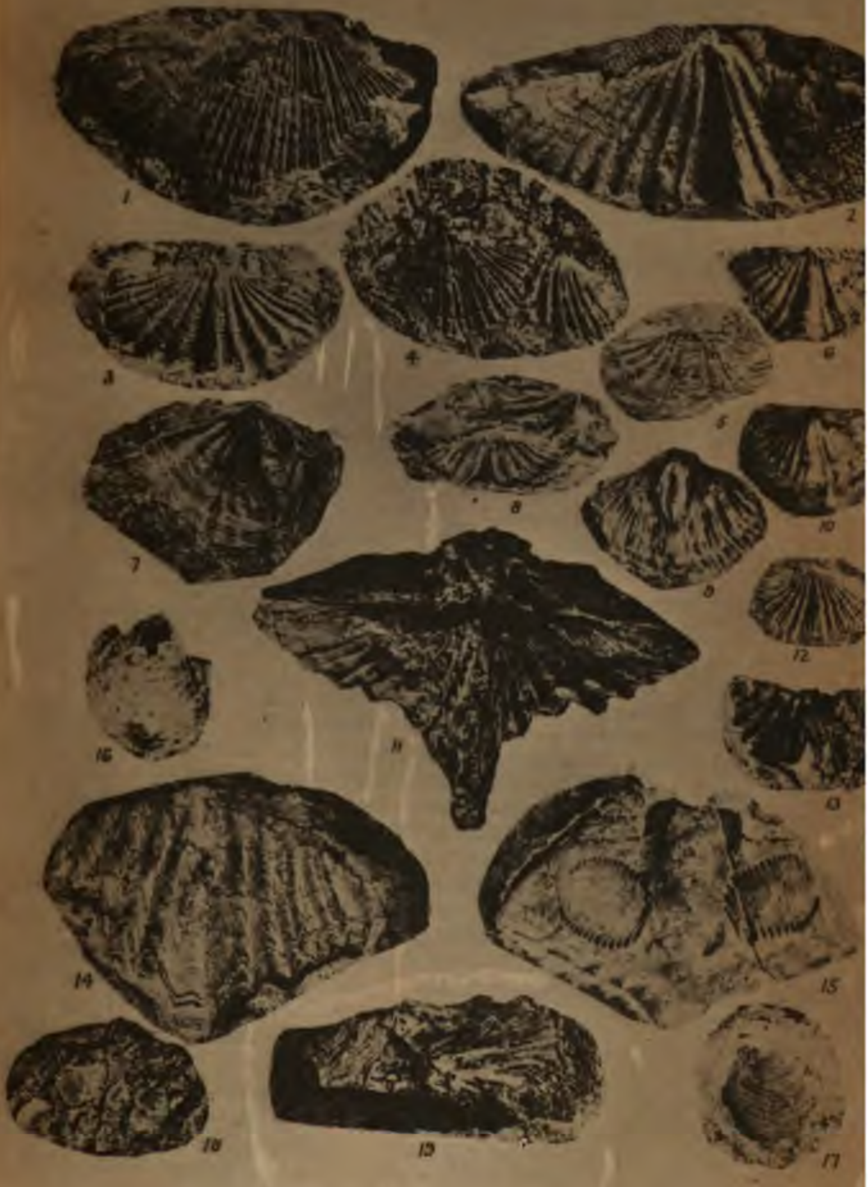
As the descriptions of the same species taken from Davidson's "British Carboniferous Brachiopoda" answer closely to local forms, I have appended descriptive extracts from this eminent authority, for the convenience of local students.

Figures of local forms are taken from select types by photography. I have also to announce the discovery of *Lophophyllum corniculum*, de Konwick. Collected by Capt. Beddome in the mudstone beds near Fingal.

DESCRIPTION OF SPECIES OCCURRING IN EUROPEAN ROCKS. ACCORDING TO T. DAVIDSON, F.R.S.

Spirifera striata, *Martin.*

A very large and variably shaped shell, transversely semicircular, or sub-rhomboidal; valves almost equally convex. In the dorsal valve the mesial fold is of moderate elevation, while the sinus in the opposite one is both variable in its width and depth. The hinge-line is either a little shorter, or as long as the greatest width of the shell, the cardinal angles being more or less rounded in adult individuals. The area is of moderate width, with sub-parallel sides; fissure triangular, and partially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covered by a pseudo-deltidium. The external surface of the shell is ornamented by a variable number of radiating ribs, which augment in number to a greater or lesser extent, from intercalations at unequal distances from the beaks; so that from 70 to 90 may be counted round the margin of each valve in adult individuals. The ribs on the fold and sinus are likewise more flattened than on the lateral portions of the shell. The surface is closely and finely reticulated. In the interior of the dorsal valve, under the extremity of the incurved umbonal beak there exists a small cardinal process or muscular fulcrum, and on either side are situated the dental sockets. The spiral cones which fill the larger portion of the shell are attached to the extremities of the inner socket-walls. The lamellæ, after having converged and given birth to the crural processes, diverge, and form the first of the 20 or 22 convolutions of which each spiral is composed. Four impressions left by the adductor muscle are visible in this valve. In the interior of the ventral valve a strong hinge-tooth is situated on either side at the base of the fissure, and is supported by a vertical shelly plate of much strength, but not advancing to any great length into the interior of the valve. Between these a large portion of the free space at the bottom of the shell is occupied by the adductor and cardinal muscular impressions, which are divided by a blunt, central, longitudinal ridge. The dimensions of one of the largest examples are:—

Length, 4½ in.; width, 6 in. 1 line; depth, 3 in. 1 line.

Spirifera laminosa, *M'Coy*.

Transversely sub-rhomboidal; valves unequally convex, the ventral one by far the deepest. The lateral portions of the shell are regularly curved, forming with the extremities of the hinge-line, acute, but not prolonged cardinal extremities; area large, triangular, more or less elevated, and divided by a fissure of moderate width. Beak small, not much produced above or beyond the level of the area. The mesial fold in the dorsal valve is broad, and more or less elevated without ribs, and corresponding with a deep and rather wide longitudinal sinus in the ventral one. Each valve is ornamented by about 20 or 22 narrow radiating ribs, intersected by closely disposed, sharp, oncentric, undulating laminæ. The measurements from two examples have produced—

Length,	width,	depth,
12;	21;	10 lines.
,, 8	,, 11	,, 6½ ,,

Spiriferina cristata, *var.* octoplicata, *J. De C. Sowerby*.

Transversely sub-rhomboidal, valves about equally convex, and at times rather gibbous; hinge-line as long as the greatest width of the shell. Cardinal angles acute or slightly rounded; area concave, triangular, and of variable width; fissure partly covered by a pseudo-deltidium; beak small and incurved. The mesial fold of the dorsal valve is more often composed of a single rib which is much larger than those situated on the lateral portions of the shell; its crest being in general rounded from the umbone to about half its length, when it gradually becomes more and more flattened as it approaches the frontal margin, but at times it remains angular during its entire length, with a tendency to the formation of a rudimentary plait on either of its slopes, so that in these rarer cases the fold assumes towards the front an obscurely triplicated appearance. The sinus in the ventral valve is deep, acute, and generally simple, but also more rarely interrupted by a rudimentary rib, which becomes visible in the proximity of the front. The valves are ornamented by from 8 to 12 angular ribs, which are, as well as the sinus and fold, intercepted by closely disposed, concentric, scale-like laminæ. The surface of the shell is also closely beset by numerous small granular (spinose) asperities; the shell-structure being likewise perforated by minute tubili or perforations.

In the interior of the ventral valve there exists a sharp elevated mesial septum, which rises from the bottom of the valve, and partly divides the spiral cones. Dimensions very variable. Three examples, of which the first two are Sowerby's original types, have afforded the following measurements:—

Length, 9; width, 13; depth, 8 lines.
„ 6 „ 11 „ 6 „
„ 5 „ 8 „ 5 „

Spirifera duplicicosta, *Phillips*.

Transversely sub-rhomboidal when adult, longer than wide, or almost circular when quite young; valves moderately convex, with a more or less produced mesial fold in the dorsal, and a corresponding sinus in the ventral one. The hinge-line is shorter than the width of the shell, the area of moderate breadth, beak incurved. Valves ornamented by numerous radiating ribs, which rapidly augment at various distances from the beaks by intercalation as well as bifurcation. Two examples have afforded the following measurements:—

Length, 16; width, 20; depth, 11 lines.
„ 16½ „ 17½ „ 10½ „

Spirifera alata, *Schlotheim*.

S. alata varies considerably in shape, according to age and individual. When adult or full grown it is transversely fusiform, being twice and even three times as wide as long (Pl. 1, figs. 23 and 27). Valves convex, deepest at a short distance from the umbone; hinge-line as long as the greatest width of the shell, the cardinal extremities being more or less attenuated in different individuals. The area is wide with sub-parallel sides; fissure triangular, and in great measure covered by a convex pseudo-deltidium; a narrow rudimentary area may be seen likewise in the smaller valve; beak small and incurved. The mesial fold is simple, of variable width, and flattened along its upper surface; while in the ventral valve there exists a shallow sinus, interrupted by the presence of a rounded slightly elevated mesial rib. The valves are likewise ornamented by a variable number of rounded, or but slightly angular, ribs; these are simple, or here or there augmented by an occasional intercalcation. In number they vary from about 8 to 30 on each valve, the larger number occurring on the most adult individuals. The ribs are also at times of unequal width, even on the same example; and the entire surface of the shell is ornamened by close and regular scale-like, concentric, imbricated laminæ. The interior of the ventral valve does not show a trace of that elevated mesial septum which is always present in *Spiriferina cristata*, *Sp. octoplicata*, *Sp. Münsteri*, *rostrata*, *Tessoni*, and other forms composing that sub-genus. The dental or rostral plates in *S. alata* are also much smaller, and I might almost say rudimentary; the muscular impressions are likewise exactly similar to those peculiar to the genus *Spirifera*. In the dorsal valve, under the extremity of the umbone, there exists a small striated cardinal process or boss, but no hinge-plate, and a little lower is seen the quadruple impression left by the adductor (Pl. I., figs. 31, 32, 33A).

Spirifera triangularis, *Martin*.

Triangular, twice as wide as long, with a straight elongated hinge-line, and slightly concave, nearly parallel-sided area, towards the attenuated extremities of which the lateral margins of each valve converge, forming acute angles with the hinge. The fissure is triangular, and partly covered by a pseudo-deltidium. The dorsal valve is less convex than the opposite one with an elevated mesial fold which commonly assumes the character of a single produced and acutely angular cuneiform ridge or rib, at times considerably prolonged beyond the frontal level of the lateral portions of the valve. On either side of this central ridge from 6 to 10 smaller ribs ornament the lateral portions of the valve. The beak of the ventral valve is narrow, produced, and incurved. A shallow mesial sinus commences at the extremity of the beak, and extends to the front, but at a short distance from its origin a mesial or central rib originates, which becomes wider and more elevated and produced as it approaches the front, and corresponds with the central ridge of the dorsal valve. Seven to 11 smaller ribs exist also on the lateral portions of the valve, on either side of the sinus. The dimensions taken from a perfect individual have produced :—

Length, 10½; width, 21½; depth, 6½ lines.

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ROOT MATTERS IN SOCIAL AND ECONOMIC PROBLEMS.

By R. M. Johnston, F.L.S.

Is the Poverty of the Masses a Necessary Concomitant of Increased Accumulation of Wealth in the Aggregate?

All observers are nearly agreed that the accumulation of wealth and wealth-producing power have prodigiously increased within the present century. Of this there can be little doubt. Modern discoveries—as regards the properties of matter, the discovery and development of new lands, the uses of steam, electricity, and labour-saving inventions in every department of social and industrial life—have enormously increased man's power over the forces of nature. With this immense gain of power vast continents of virgin forest and barren swamp have become gardens of plenty. Rivers, mountains, and other formidable obstacles to communication or distribution of products have been bridged or pierced by railways, roads, and other superior means of distribution; and the wide ocean, connecting far distant lands, now forms the easy and open highway of magnificent steamers, which vie in regularity and speed with the railway train in bringing to local markets daily supplies of the fresh meat, fish, fruit, and cereals of lands many thousand miles away. As a natural consequence famines, such as are known to have been so common and so terrible in England in the immediately preceding centuries, are rendered an impossibility.

How is it, then, that we are again brought face to face with the old terrible problems: "The Misery of the Masses," "The Labourer's Struggle for Existence," "The Growth of Poverty," "The Increase of Pauperism and Crime?" If we can judge by the popular literature of the day, the state of the masses in Europe seems to be verging into as hopeless a condition as that which existed prior to the introduction of our vaunted discoveries.

Indeed, one writer, who recently has been heard above all other claimants for reform, confidently affirms that "it is true wealth has been greatly increased, and that the average of comfort, leisure, and refinement has been raised; but these gains are not general. *In them the lowest class do not share.*" He broadly insists that increase in poverty is the constant concomitant of increase in aggregate wealth, and that this constant "association of poverty with progress is the great enigma of our times." Is it true, as this writer confidently affirms, that with all the advantages which man has gained in his increased and increasing command over the forces of nature, our present civilisation has by its customs and provisions barred the effectual distribution of accumulated wealth; and the only effect produced is that of making the rich richer and the poor poorer?

This cannot be answered effectively without some enquiry into that form of wealth which constitutes man's chief satisfactions.

Are these sufficient in the aggregate to suffice for all, if proper means for effecting distribution were employed, supposing such means were possible? Or is the aggregate supply of primary wants insufficient to provide all needs, even were the most thorough means devised for its distribution?

WANTS OF MAN.

The satisfaction of the wants of man is the mainspring of all his activities. Wants are interminable. Some affect his very existence, while others only concern his greater degree of comfort or happiness. In all enquiries into matters deeply concerning the existence and welfare of man it is well, therefore, to keep these fundamental distinctions clearly in view; for not a few of our misconceptions arise from a failure on the part of social and political economists to establish a satisfactory classification of wants according to their varying importance.

Broadly speaking, these may be divided into three great groups:—

(1.) Wants Essential to Life Itself.
(2.) Wants Essential to Comfort.
(3.) Luxurious Wants.

Whatever eccentricities may be exhibited by isolated individuals at times, it is unmistakable that the fierceness or intensity of the struggle for wants among communities is determined by the *nature* of the wants; and, invariably, so long as the reason of man is preserved, the greater intensity of the struggle—beginning with the most important—is in the order before given, viz.:—

Wants essential to—

(1.) Life.
(2.) Comfort.
(3.) Luxury.

Man can, and, unfortunately, the masses of men are often obliged to, exist without the enjoyment of luxurious wants. He may even be deprived of all wants beyond the *first* group and still maintain a more or less extended life-struggle with misery of some kind: but if the wants of the *first group* be ever so little curtailed below a certain minimum, he will speedily perish miserably.

Preserve to man his life, and if needs be he will eagerly exchange for its preservation all his comforts and luxuries. Deny him life, and all the Economist's *wealth of exchange* becomes to him as dross—absolutely valueless. This being so, let us endeavour to investigate some of the more important social problems closely connected with the welfare and progress of man. It is for many reasons necessary at this stage to confine attention to those primary wants essential to life itself; and for greater clearness these may be restricted to that minimum of each great want necessary to maintain the life of each person. The exact minimum of these, whatever their form may be, depends upon the energy destroyed by work, and upon the physical condition of the labourer's environment, and may be stated thus:—

The minimum to maintain existence of

Food.
Shelter.
Rest.

Without a certain minimum of these, man, like all living organisms, must perish inevitably.

DIVISION OF LABOUR—ADVANTAGES AND DEFECTS.

Division of labour necessary to produce necessary satisfactions, and to distribute them in large civilised communities, undoubtedly ensures greater skill, and prevents unnecessary waste of the aggregate time and energy of the individuals. Were it not for this provision no country could sustain the life of large numbers. This division of labour, however, rests upon the tacit understanding that energies in other directions than that of actually producing food may constantly be exchanged for food and other primary wants. Individual societies, communities, and nations are alike in this respect; for no matter the skill, time, and labour proffered or applied for or in the production of other than primary wants, it is necessary that they be constantly exchangeable in sufficient amount to obtain at least that minimum of primary needs from other persons or communities, who, under this system, are supposed to produce a sufficient surplus for the satisfaction of all other members of society not immediately engaged in the production of primary wants. Were it not for this understood assurance, the present civilisation—with special centres of manufactures for the world at large, its defined local division of labour and individual rights in large areas of land—would be altogether impossible.

Among the conflicting opinions of Political Economists, Socialists, and Communists, there is at any rate this one fundamental point of agreement, *viz.*, that by a proper division of labour or services, the sum total of human satisfactions are greatly superior, and are enjoyed by vastly greater numbers than would be possible to men were each to work in a state of isolation, and each one obliged to attempt to create the whole round of his own requirements. Let us take it for granted, then, that division of services is a necessity; but while so doing let us bear in mind that the greater satisfaction of wants in the aggregate may be attained, and yet owing to an imperfect scheme of distribution a sufficiency, nay, even the minimum of primary satisfaction necessary to maintain life, may fail to reach many; and hence it may appear that much of the idleness, pauperism, crime, misery and death experienced in crowded centres is due to the defects of distribution.

Let us therefore examine this root difficulty, free from the clouds of irrelevant or less urgent considerations. Division of labour without facilities for exchange may render a unit more helpless in such a scheme than he would be in a savage state. Much ingenuity and ability has been exercised by many writers in showing to us, as Bastiat does, the glorious provisions of one of the so-called social harmonies (*Liberty alias Competition*) in preventing monopoly, and in effecting the distribution of wealth. And it may be at once conceded that human society does reap all the advantages claimed on behalf of competition.

The question, however, is not—Does competition effect much good? That may be readily conceded. But confining attention to the minimum of primary wants alone—Do the combined effects of division of services, competition and modes of exchange now existing, provide for the *preservation of due proportions between the different classes of services*, so as to ensure the production of primary needs in sufficiency for the wants of all; and are the means of exchange sufficiently perfect to secure with more or less certainty a due modicum of primary needs to all. In a word, is the "all for each" as effectively complete as the "each for all?"

If this latter provision be defective—and this unfortunately seems too true—can the defects be removed? And if this be impossible—can the evils be minimised to any extent? All possessors of services must be enabled to secure primary wants, or they perish. References to the wide distribution of wealth in exchange or commercial *value*; or to standard prices or wages—low or high—are utterly misleading. Without the power to acquire, or the actual possession of a due provision of that portion of exchange wealth—not necessarily possessing a high exchange value—the whole aggregate of the remaining part of the world's *wealth in exchange* would be worthless; for it would fail to preserve the life of the man destitute of primary wants. This is the root difficulty; and it is forcibly exemplified in the first notable exchange recorded in sacred history between the typical representative of the hunter of wild animals, and the more skilled and peaceful agriculturist.

" . . . And Esau was a cunning hunter, a man of the field: and Jacob was a plain man dwelling in tents. . . . And Jacob sod pottage: and Esau came from the field and he was faint: And Esau said to Jacob, Feed me, I pray thee with that same red pottage, for I am faint. . . . And Jacob said, Sell me this day thy birthright. And Esau said, Behold I am at the point to die, and what profit shall this birthright do to me? And Jacob said, Swear to me this day; and he sware unto him: and he sold his birthright unto Jacob. Then Jacob gave Esau bread and pottage of lentiles; and he did eat and drink, and rose up and went his way; thus Esau despised his birthright."—(Genesis xxv., 27-34.)

It is fortunate for Esau that he had the power of effecting an exchange, and that, notwithstanding the exorbitancy of the seller's terms, he had no hesitancy in exchanging (or despising as it is stated) the less needful wants for the more pressing or primary; for in the trial of Job's integrity and fortitude it is affirmed, with truth, that skin for skin, all that a man hath will he give for his life.

Unfortunately for the working class breadwinner, his only birthright is physical power and manual skill, and although these are all he can offer for his life needs, he cannot always as a competitor effect the necessary exchange; and too often he, and those depending upon him, travel the swift road to beggary and death.

Thus there are still defects, whether remediable or otherwise, in the present civilisation, so long as these fundamental necessities of a power to exchange with primary wants are imperfect, *e.g.*: certain divisions of humankind are not directly engaged in producing primary wants *for themselves*. They are mostly engaged merely in rendering more or less skilled services, in return for tokens (money or other medium) understood to have at least the power of effecting corresponding *definite supplies* of primary wants. But this division has another difficulty.

The actual owner of the power (rich capitalist) to effect the production of things which may be exchanged for a corresponding quantity of primary wants, may in all likelihood be able to effect such exchanges; but the poor capitalist, the possessor of the power of mere services, such as the navvy, the house servant, the blacksmith, may often be unable to exchange his services towards the production of these very things; and under such conditions as the needful, exchange cannot be effected, the unemployed wage-earner in the division of human labour must be supported by drawing upon a more or less limited surplus previously earned; failing that he must either borrow, take the risk of violent means to secure primary wants, be fed by private or public charity, or die of starvation.

This, then, is the problem of problems of the present day. References to current high rates of wages, the low prices of provisions, or the increasing aggregate value of wealth in exchange, do not always disclose this skeleton in the social cupboard. When the ship of society is barred into many more or less water-tight compartments the ship itself may not founder, although one or two minor chambers be damaged and water-logged, and their contents destroyed. If the larger and more important chambers, however, be destroyed the whole ship may founder, and those who may effect escape may be small indeed. This allegorical picture must not be pressed too hard. It may be sufficient, however, to draw attention to a dangerous side of the division of labour composition of modern society.

But, says the theorist: True, his services were shut out by over-competition in that particular place or in that particular occupation; but if he only knew at that moment that by transferring his services to other employments, or to the same occupation in another place, the balance of service for service would be adjusted, and the life of himself and his dependants would be saved. Ah, if he only knew! But the possession of knowledge is in itself practically a form of wealth, and that he did not possess any more than he did the necessary capital to acquire the necessary skill in the new occupation calling for services, or in the necessary capital to transfer himself and his household to a great distance where his own special skill was then in demand. We may therefore summarise the difficulties lying at the root of all social problems as follows:—

(1.) All breadwinners and their families to maintain existence must possess primary wants, whether they can effect exchange of services or not.

(2.) Many breadwinners—whether due to lack of knowledge or inability to change their occupations or locality—cannot obtain employment, and therefore cannot effect exchange.

(3.) Such of the latter as by former misfortunes have been deprived of every form of wealth in exchange, must beg or steal from public or private resources, or die of starvation.

Thus it is shown that one of the great economic harmonies in *competition*, while it effects much good in distributing wealth and breaking down monopolies and privileges, and in enlarging the domain of community in the enjoyment of the gratuitous products of nature and invention, it also, as one of the mills of God, directs its force terribly on the mere monopolists of bone and muscle; competition grinding them smaller and smaller as its force is augmented by increasing numbers.

FURTHER DIFFICULTIES CONNECTED WITH THE DIVISION OF LABOUR—ALLOCATION.

One of the most formidable difficulties connected with the division of labour is *allocation*; for it is evident that if in the technical training of the young due regard be not paid to the chances of finding employment in the service to which the future breadwinner aspires, disaster or a disappointed life may be the result. This, being a relative matter, applies to a small community as well as to a large one. Few take into consideration that there is a natural law in operation which as surely determines the numbers required for each great class of employment as do the natural laws which locally determine the times and relative heights of the tide. No social advancement by means of the higher education of the people can ever alter the relative numbers of the various branches of human service; and should it be thought possible that the education of the masses exerts any influence in the nature of its training in disturbing the necessary proportions of each great group of services upon which our lives and our civilisation depends, it would certainly prove that the general spread of higher education was a curse and not a blessing.

Services would never become a marketable commodity of value in exchange if it were not for wants. Kinds of services, therefore, must be exactly proportionate to kinds of wants. The wants which demand the expenditure of the greater amount of labour must necessarily absorb the greater amount of persons requiring employment without regard to their capacities, attainments, or personal desires; and, so far as the mass of human beings are concerned, there is no choice.

The great wants, food, clothing, and shelter, are by far the greatest factors in the determination of the aggregate numbers that must be employed if the wants are to be satisfied. The same three great wants also determine the necessary amount and proportions of capital, machinery, and land to be employed, together with the necessary proportion of labourers for each kind of occupation which directly or indirectly is somehow utilised in the production of the said three great wants.

It is true the strict average proportions of the various classes of labour machinery may not be found to be quite the same in each country; but this does not affect the aggregate of all countries. It is not absolutely necessary that the manufactures and agricultural industries of any one country should preserve the world's strict average proportions to each other, so far as that one country is concerned, so long as it is free to make necessary exchanges with other countries for disposing or making good their respective local surpluses and deficiencies. Nevertheless, countries confined to the production of their own wants—or, what is the same, the world as a whole—must preserve the strict average proportion and quantity of labour and machinery in the production of those three great wants which are the mainsprings of all human activities and efforts. It is necessary, therefore, to make a very wide net to obtain approximate information with respect to the amount and due proportions of all kinds of services employed in the production of the whole round of wants of each country. It is unfortunate that figures relating to the occupations of all countries are not accessible, but reference to the ascertained occupations of Australasia, United States of America, British India, and seven principal States of Europe, embracing 433 millions of people, and representing all climes and all forms of industry, afford a basis wide enough to secure very accurate information.

The figures contained in the following table of classified occupation of these countries afford valuable information with regard to the definite proportions of the division of labour engaged in the production of human wants:—

PROPORTIONAL CLASSIFICATION OF THE OCCUPATIONS OF ALL PERSONS ENGAGED IN THE SUPPLY OF HUMAN WANTS :—

COUNTRY.	Population last Census (1=1000).)	Breadwinners (Percentage).									Dependants (Percentage).			All.	Persons supported by each Breadwinner.
		1	2	3	4	5	1-5	6	7	6-7	8	9	8-9	1-9	
		Professional.	Domestic.	Commercial.	Industrial.	Agricultural.	Total of Group.	Property, Rank.	Others.	Total of Group.	Wives, Children, Scholars.	Paupers, Criminals.	Total.	All.	
															No.
England, Wales	26,094	2·4	6·9	3·7	24·5	5·3	42·8	...	...	...	...	...	...	100	2·29
Scotland...........	3,735	2 6	4·7	3·5	24·4	7·0	42·2	...	...	...	...	...	...	100	2·33
Ireland	5,174	3·8	8·2	1·4	13·3	19·0	45·7	...	...	...	...	...	...	100	2·15
United Kingdom ..	35,003	2·7	7·0	3·3	23·0	7·5	43·5	...	...	...	...	...	...	100	2·25
Six Colonies of Australasia :—															
Victoria	862	1·6	4·5	4·1	18·8	14·5	43·5	0·2	0·6	0·8	54·5	1·2	55·7	100	2·24
Queensland	213	1·4	5·0	5·1	18·3	15·7	45·5	0·1	0·6	0·7	52·8	1·0	53·8	100	2·16
South Australia	280	1·4	4·1	4·8	16 5	12·6	39·4	0·3	0·7	1·0	58·9	0·7	59·6	100	2·47
Western Australia ..	30	1·6	3·9	5·1	12·6	16·1	39·3	0·3	1·6	1·9	56·2	2·6	58·8	100	2·43
Tasmania	116	1·5	4·6	3·4	16·5	16·9	42·9	0·5	0·6	1·1	55·5	0·5	56·0	100	2·27
New Zealand	490	1·5	4·1	4·3	16·8	11·2	37·9	0·1	0·6	0 7	60·7	0·7	61·4	100	2·56
Total of Six Colonies of Australasia	1,991	1·5	4·4	4·4	17·7	13·7	41·7	0·2	0·6	0·8	56·6	0·9	57·5	100	2·35
United States	50,155	1·8	6·3	3·6	7·6	15·3	34·6	...	...	...	...	...	...	...	2·83
Prussia	27,279	2·1	3·2	3·3	13·0	17·0	38 6	...	...	...	...	...	...	...	2·54
France.............	37,321	1·8	6·3	4·2	12·0	18·0	42·3	...	...	...	...	...	...	...	2·32
Austria	22,144	1·9	4·0	2·0	10·0	28 0	45·9	...	...	...	...	...	...	...	2·14
Belgium............	5,520	3·0	9·0	4·4	17·2	14·6	48·2	...	...	...	...	...	...	...	2·04
India	253,891	1[illegible]	1·1	1·4	14·6	28·0	46·2	...	...	...	...	...	...	...	2·13
TOTALS	483,304	1·6	3·0	2·3	13·3	23·2	43·4	...	...	...	...	...	...	...	2·26

From this table we learn that all people are divided into two important groups:—*Viz.*, breadwinners, representing about 44·2 per cent. of all persons, and non-breadwinners or dependants, composed mainly of wives and children, representing 55·8 per cent. of the total populations. Thus it appears that the wants of all must be provided by the service of less than half the total number of those who consume wants. The proportions of the breadwinners necessary to effect this service are as follows. That is to say, for every 100 persons engaged in services of exchange value there must be on the aggregate the following proportions nearly:—

PERCENTAGE PROPORTION.

Agricultural and Pastoral services ...	52·5
Industrial services	30·1
Domestic services	6·8
Commercial services	5·2
Professional and other undefined services	5·4
Total	100·0

It will be seen that the simple services of the agriculturist and herdsman are by far the most important (52·5 per cent.), and that the next in importance are the industrial services, embracing all artisans and labourers, representing 30·1 per cent. The higher skilled workmen of this group only represent about 11 per cent. of all services. As the balance of services—commercial and professional—only amount to 10·6 per cent., it follows that of all services required only 21·6 *per cent. demand skill of a higher order;* and that 78·4 per cent. represent agricultural and other labourers and domestic servants, in respect of which skill of a high order is not absolutely requisite.

It is largely due to the flooding of particular kinds of employment beyond the strict proportions which local wants demand that inconvenience or distress is felt in young as well as old countries. The numbers which can find entry into the higher industrial, the commercial, and professional divisions cannot, without unhealthy competition, be increased beyond the relative proportions which these divisions must bear to the producing industries of the particular country; and these dominating industries in Australasia are agricultural, pastoral, and mining. Employment in other divisions can only follow substantial increases in the three industries named; for manufacturing industries cannot alter their present proportions independently, as in England, until such time as they are able to manufacture for the markets of other countries than the local one. This applies much more strongly to the smaller division represented by unskilled labour (not agricultural), and by the commercial and professional classes. These certainly may only increase according to their rigid proportion; and this must be determined by a previous increase in the fundamental producing industries of the particular place.

The principal producing industries of the place may increase irrespective of other local divisions (*i.e.*, agricultural, pastoral, and mining), as their products may find the necessary consumer in foreign markets. Whatever influence, therefore, may bar the progress of the dominating producing industries of the place *must also bar occupations in all other divisions of services.*

It is clear from what has been stated that applicants for a given kind of employment may often fail, not because there is no room for more labour, but because the *direction* in which the applicants have been trained, or in which they desire to be employed, is out of harmony with the natural or local proportions of that particular service necessary in the production of general wants.

From this cause arises much difficulty and distress. It largely adds to the proportion of *dependants,* and consequently the direct or indirect strain (*i.e.*, support of friends, relatives, private and public charities) upon the actual breadwinners becomes oppressive. I do not here touch upon artificial aids to local production in its effects upon the alteration or disturbance of the relative proportions of the division of services upon which such aid must have an immediate effect, further than to remark, that if the aid by tariff duties or other means enables the local division at once to cover the ground formerly supplied by foreign industry, it can only do so either by increasing the machinery or the relative proportion of numbers employed locally in the division of service affected. The advantage or disadvantage of adopting such a policy is hereafter discussed. It is sufficient for the present purpose to show the possible effect it may exert upon local *employment* alone.

CAUSES OF EXISTING POVERTY AND MISERY.

It cannot be denied that in spite of the great accumulation of wealth, and the increased command over the forces of nature during the present century, that there is still to be found much poverty and distress, and that much of it is due to the unequal distribution of wealth; and whether we may or may not be able to point a remedy, it is utterly repugnant to the best feelings of human nature to sink into the despair or apathy of many who say, "Let alone; whatever is is best or worst, and cannot be helped." Whatever errors the Socialists and Communists are chargeable with they must be credited with warm aspirations for the amelioration and improvement of suffering humanity, and are free from the charge of indifference. The latter, however, are too emotional to perceive the great difficulties of the problems which have always engaged the deepest attention of earnest Social Economists, and are too ready to advocate the introduction of their own pet schemes, without having taken sufficient trouble either to test their adequacy, or to fathom the true nature of fundamental difficulties, which would in most cases be made vastly more formidable by the various plans propounded by them for their removal. Thus some, having been misled by the assumption that all our evils are due to individual property right and unequal distribution of wealth, employ all their ingenuity to show that all existing evils are attributable to these, and to these alone.

Yet there are many other influences far more potent for evil which no scheme yet propounded by Political Economists, Socialists or Communists may wisely undervalue or ignore. Of such are the following:—

(1.) The superabundant proportions of human beings in existence who, free from restraint, are naturally disposed to be idle, sensuous, and wicked; or who are ignorant, foolish, and improvident.

(2.) The difficulties of supplying other motives more adequate than self-interest to so many in effecting conformity to the necessary social laws and virtues, and as a spur to industry and useful application of powers.

(3.) The inequalities of different habitable portions of the earth as regards productiveness, climate, disease, density of population, and the difference of civilisation and racial characteristics.

(4.) The periodic failure of food supply (famine), whether due to seasonal influence, exhaustion of soil, violence, wilful waste, or improvidence.

(5.) Effectual means for elimination from society of the more pronounced forms of hereditary vice and madness which, if allowed to persist, would endanger society.

(6.) Absence of facilities for relieving the pressure of population in over-peopled lands by migration.

(7.) Difficulties connected with free exchange of products between different nations whose artisans and labourers are living under different material and social conditions, *e.g.*, slave labour and free labour.

(8.) Difficulties in effecting adequate exchange of products with other nations where, as in England, local foods, products, and the raw materials for manufacture are locally far below the level of requirement of an ever-increasing population.

(9.) Difficulties and dangers arising from local increase of population, especially when foreign, thinly-populated lands are forcibly closed to emigrants, as in the experience of the Chinese.

(10.) The misery caused by war, strife, murder, accident, painful disease, and preventible forms of death.

(11.) The terrible root difficulty connected with either (1) decrease, (2) stationariness, or (3) rapid increase of population.

(12.) The absolute limits of space requisite for the reception and sustenance of man.

The last two form *the population difficulty;* in itself the chief cause of human trouble.

This difficulty cannot be banished by sentimental tirades or bad argument. No tinkering with schemes affecting "Rights of Property," "The Battle of Interests," "Competition," or "Community of Goods," can do other than make the dominant difficulty more formidable. As this great difficulty is often denied or misunderstood by those who attribute all the evils to rent and free competition, it may be well to touch upon these important subjects separately.

SATISFACTION OF WANTS AND THEORY OF OBSTACLES CONSIDERED.

Human satisfactions are enjoyed to the fullest extent with the smallest expenditure of time and human energy in regions where the natural sources of human satisfactions are vast and rich, and under conditions where the fewest obstacles intervene between actual producers and actual consumers. Extra time and labour, often necessarily spent in *mere distribution,* are in themselves *obstacles,* and directly tend to lessen the quota of satisfactions which might be enjoyed by each individual. All conditions, therefore, which necessitate the larger expenditure of time and labour—(such as extreme distance between the several kinds of producers and manufacturers) as well as conditions which necessitate extra provision against loss or waste of satisfactions produced or being produced (such as dangers from loss by storms, inundations, fire, waste by war, civil strife, robbery, depredations by wild animals, idle and useless dependants, plagues of parasites, disease, etc.), curtail of necessity the amount of necessary satisfaction which otherwise might be enjoyed by each useful human unit. Obstacles, therefore, greatly reduce the amount of human satisfactions so far as each individual is concerned, although in the aggregate this is not so easily comprehended. Lowness of nominal prices is not a correct index of conditions most favourable for the attainment of the greatest amount of satisfactions, with the smallest expenditure of time and human energy: for it often happens that low prices may be caused by *excessive expenditure* of human energy forced upon a struggling producer; or by poverty due to forced idleness on the part of a large body of consumers. While it may often happen—as in young colonies—that a high price is no index of a lower supply of satisfactions; but rather of the smaller amount of obstacles intervening between consume and producer, and gratuitous sources of nature; the smaller amount of enforced idleness on the part of consumer, giving him a greater purchasing power; and the greater advantage of the producer, due to similar causes, enabling him to obtain all the most necessary round of satisfactions with a smaller expenditure of time and labour. Mere cheapness of satisfactions, therefore, is not a reliable index of individual welfare. Purchasing power, as indicated by expenditure of time and labour, is the only true index as between countries differently circumstanced, and this purchasing power of the consumer—unlike the unreliable *nominal cost or wage*—is always in harmony with the amount of obstacles intervening between the actual producers of satisfactions and the actual consumers.

This method of determining the condition of different communities will be better understood if we carefully investigate the effect of obstacles more closely. As the factors are variable and numerous, the only way to arrive at true conclusions is to approach the question by the mathematical method: thus:—

Let N=Natural agents and products; or the gratuitous forces of nature.

P=Productive power of human agencies, including skill and energy, and skilled appliances.

O=Obstacles intervening between NP or producer and consumers.

C=Producers, dependants, distributors, etc., representing the living population; or consumers.

Then $\frac{NP-O}{C}$=Represents the amount of the average satisfactions provided for each individual.

And $\frac{NP+O}{C}$=Represents the nominal cost of satisfactions for each individual on the average—or it may fairly represent the amount of exertion or energy expended by human energy.

Having stated the general effect of obstacles between direct producer and consumer as minimising the actual supply of necessary satisfactions to each consumer where the values of N and P and C are constant, it follows inevitably that the amount of satisfactions to each individual is in direct correspondence to the amount of O; increasing with its decrease, and decreasing with its increase.

The effect upon *price*, however, is exactly the reverse of this, as a *definite amount of satisfactions increase* in price in correspondence with the increase in obstacles (O), and decrease correspondingly with its increase.

This law is not invalidated, because in particular cases (1) price is comparatively low when O is absolutely great, and conversely (2), price is comparatively low when O is absolutely small; for in every such case there must be corresponding dissimilarity in the other elements to explain this effect: *i.e.*:—

The effect (1) could only happen in cases where either N or P is abnormally or relatively great, or C is comparatively small; and similarly the effect (2) could only happen in cases where either N or P is abnormally or relatively small or C is comparatively great.

The failure to grasp these fundamental considerations is the chief cause of the blunders in all reasonings connected with questions related to the policy of different nations in respect of artificial restrictions, hindrances or facilities in the interchange of foreign products.

To make this matter more clear it may be advantageous in demonstration to set forth a number of examples for the sake of illustrating the important truths involved in the effects produced where one or all the factors are different in value:—

(1.) Where soil, climate, or natural utilities are particularly advantageous the value of N is at its best or maximum$=N^m$

(2.) Where skill and energy exist and are employed to the best advantage the largest results are attained for $P=P^m$

(3.) Where the smallest number of obstacles occur between NP and C, the largest amount of satisfactions fall to the share of $C=C^m$

(4.) The most perfect conditions favourable for effecting the highest amount of satisfactions to each individual consumer coincide with $\frac{N^m\, P^m - O^m}{C^m}$

Or,

If we separate P^m into labourers (L), and instruments (1) the fruit of former efforts saved from previous consumption, and devoted by inventive skill and energy to more or less permanent aids to L, we have a more perfect statement of (4) thus:—

$$\text{(A)}\quad S^m = \frac{N^m\,(L^n\,I^m) - O^n}{C^n} =$$

The ideally best conditions for the attainments of the highest satisfactions of human wants with the least expenditure of human energy.

Or greatest quota of satisfactions.

Understanding by *m* and *n* the indices of the *maximum* and *minimum* of the various conditions, then it would logically follow that the converse or worst possible conditions for attaining the necessary satisfactions of human wants, involving also the greatest expenditure of human energy, would be when the equation becomes

$$\text{(B)}\qquad \frac{N^n\,(L^m\,I^n) - O^m}{C^m} = S$$

This being so, it also follows that this stage will be coincident with conditions which favour the maximum of cost for each satisfaction, thus:—

$$\frac{N^n\,(L^m\,I^n)\ +\ O^m}{C^m} = P$$

Similarly the conditions favourable to the attainment of minimum of lowest cost or price (P^n) would coincide with stage A, thus:—

$$\frac{N^m\,(L^n\,I^m)\ +\ O^n}{C^n} = P^n$$

Reasoning from these premises it is clear that the results S and P, or their values, can never be satisfactorily known, unless we can gauge the values of their respective co-efficients. That is, we must know not merely what is the tendency of any one factor—but we must also know the tendency of all factors affecting the problem. Nay, more; if Political Economy is ever to be dignified by the name of "The *Science* of Political Economy," it must not merely take cognisance of the tendency of every one of these factors, but, like the skilled physicist, its disciples must not talk of the "teachings" "or conclusions" drawn from them until they are prepared to place approximate values against the tendency of each factor, and then to strike a balance showing the ultimate effects of the ever-varying combinations in ever-varying localities.

The difficulty of the problem is no excuse for ignoring the necessity for the adoption of this course. Hitherto, to a great extent, the subject has been governed by the more or less plausible generalisations of mere literary men; and their deserved fame and undoubted ability and skill as such have given them a prestige in political matters to which they are not entitled from a practical or scientific point of view. That they have done good service in arousing and sustaining attention on such important matters is readily admitted; but further progress is impossible so long as the inexact methods of the mere literary polemist are employed. In future the progress of Political Economy as a science depends upon demonstrations based upon quantitative analysis, and not as heretofore upon authoritative dogmas based upon the qualitative analysis of any *one* factor of the problem arbitrarily chosen from a compound or complex equation.

It is obvious that we may concur with most of the writers on Political Economy as to the general tendency of any one influence; but while this is so it may not be a safe proceeding to trust the effect of this one tendency—even admitting its importance—as determining the ultimate conclusion; for other tendencies, minus or plus, must be reckoned with before any reliable conclusion can be arrived at. Pathos and literary merit are powerful adjuncts, no doubt, but in the solution of political problems they are worse than useless where complete and exact methods are eschewed.

The Best Mode for Effecting the Highest Quota of Satisfactions with a Minimum of Trouble Depends Upon the Local Value and Extent of Natural Sources of Supply.

The principal material satisfactions essential to the happiness and cultured content of human life primarily depend upon natural sources of supply, and that country whose natural sources afford the greatest potential of elements which may be made to contribute to the material satisfactions of cultured men, is also the country wherein the greatest number of people may best fulfil all those mutual services to each other which cover the whole round of wants of an ideally happy community. The essential natural conditions for the sustenance of a highly-cultured community, and permitting a natural, healthy expansion, are:—

(1.) Large area covering all zones of climate favourable for the production of all reasonable wants, and possessing richly all the elements essential to production, such as water, fertile soil, the varied mineral and vegetable products, and such flocks and herds as most contribute to the welfare of man.

(2.) Division of labour—each division carefully apportioned in relation to the probable amount of different satisfactions required; and each labourer in every division carefully trained in that branch of work to which he has been apportioned.

(3.) The creation and maintenance of instruments which best supplement man's efforts in modifying and distributing the products derived from natural sources, and so enabling each unit to enjoy the maximum of desirable satisfaction with that minimum of exertion which is most conducive to the health and happiness of the individual.

Now, if it were possible to find such a combination of favourable conditions, wherein all the wants of man could be completely met, it follows that interchange with other countries, so far as material needs are concerned, would not only be unnecessary, but *disadvantageous*.

It is true, on moral grounds, a nation enjoying the maximum of satisfactions with a minimum of exertion or maximum of ease, might either reduce the amount of satisfactions or increase its exertions for purposes of benevolence as directed towards a country less favourably situated; but there would be no such necessity on commercial grounds as laid down by the earlier economists, except upon the plea that we should buy in the cheapest market. But this last plea, the favourite maxim of Free Trade theorists, ignores many consequences of the most vital importance.

First, the ideal state contemplated had already discovered and achieved that final state of content or *end* to which a people can aspire to—that is, a maximum of desirable satisfactions combined with a minimum of reasonable exertion. This being so, why should they attempt to procure this end by another *method* untried by them, seeing that they could not improve their condition in this way, but might make it worse. But as this plea must be discussed, let us see under such circumstances what it might lead to.

BUY IN THE CHEAPEST MARKET.

In our ideally perfect state, let us for convenient reference call it "Euphrasia." One of the fundamental conditions regulating its well-being is, that all for each is considered of as great if not greater importance as each for all.

The favourable natural conditions were experienced to be such that the round of wants of all might be satisfactorily supplied without demanding from any one group of its divisions of labour more than 44 hours of public labour per week. But it was also carefully determined that although a certain aggregate of labour when properly directed would affect this desirable end, a corresponding or even a much greater amount of labour could not produce the same result if the previously carefully arranged and periodical regulation of the apportionment of labourers were subsequently disturbed in an arbitrary way. Every arbitrary disturbance of the proportion of labourers trained and originally apportioned to a special work or function, has the effect of lowering the purchasing power of the section which was arbitrarily increased, because it introduced either curtailment of employment, wrongful competition, over-production, or diminished purchasing power within that particular section of the division of labour; and in the section from which they were arbitrarily withdrawn, it either lessened the amount of aggregate satisfactions required for all; or, if it have not that effect, it increases the hours of labour of those within the division beyond the maximum standard without additional recompense for increased exertion. If, however, the additional hours are rewarded by extra satisfactions, it must be at the expense of the general consumers, thus lessening their average of aggregate satisfactions.

The wrongful over-production is a direct loss to the whole community so healthfully regulated by community of interests.

Oh! but your ideal Euphrasian forgets, says the Economist, that the surplus of A division might by interchange with another nation be made to restore the balance thus arbitrarily destroyed by A recompensing through products needed in division B where a deficiency was caused. This is true, but at best this course only helps to restore the loss occasioned by the arbitrary disturbance of the apportionment of the local Euphrasian division of services. Nay, more; the loss occasioned could not be fully restored by *an equal exchange of labour and skill*, for the exchange with the distant foreign country involved a fresh expenditure of labour in transfer and agencies of exchange—thus increasing the value of O or obstacles—between producer and consumer, and so inevitably lessening the quota of the essential material satisfactions to be divided among consumers. It must be borne in mind that Euphrasia is assumed to possess the maximum of favourable natural resources—plus best art appliances—and consequently the restoration of the destroyed equilibrium in Euphrasia could only be effected by a skilled people, who of necessity were forced to adapt themselves to circumstances by either being satisfied with a lower requirement of wants than that enjoyed by the Euphrasians, or by a similar standard of material satisfactions gained at a much greater expenditure of labour.

For the sake of illustration, let us further examine this theory of obstacles. It will readily be granted that where two producing centres are situated at vastly different distances from consuming centres, that supply from the nearer producing centres can be effected by a much smaller expenditure of labour than by the more distant centre of production.

Thus, if A be 8,000 miles distant, and B 40 miles, it follows that the extra labour and time consumed in carrying the extra 7,960 miles is a serious disadvantage. Men do not consume distance. In itself it does not add a jot to the ultimate material wants of man otherwise produced. Distribution is certainly a necessity, but the smaller the need for distribution the larger the produce to be divided, for it is obvious that the more machines and human beings that are abstracted from direct production of essential satisfactions, the smaller is the quantity falling to the share of each consumer of wants. Thus, if 100 producers and 50 distributors provide the ideal quota of wants of an Euphrasian at the maximum of eight hours per day—say 10 wants per day, then the 100 producers must each have produced 15 wants, for consumers include producers, and non-producers or producers and distributors, and these number 150, and

$$\frac{100 \times 15}{150} = 10$$

for each consumer: or on the basis of exertion which lies at the root of price or cost, we might put it that for the aggregate hours of labour in producing and distributing each consumer was put in the possession of 10 wants. Now, if we increase obstacles we cannot supply the same number of wants without individually increasing the hours of labour. Thus, if the additional distance involves the labour of 50 additional distributors, and if producer and consumer alike share the additional labour thrown upon them, we have

$$\frac{200 \times 10}{200} = 10$$

$$= \quad \times \quad = 10.$$

Thus, to maintain the same share of wants as formerly, the necessary increase of 50 non-producers or distributors involved an extra two hours labour per day, or 25 per cent. extra exertion on the part of all breadwinners. In like manner it may be shown if the amount of exertions per individual remain undisturbed—then the amount of wants formerly supplied to each consumer must be lessened, thus:—

$$\frac{150 \times 10}{200} = 7{\cdot}5 \text{ wants per consumer}$$

Thus we have with the increased obstacles a diminution in the satisfaction of wants equivalent to a reduction of 25 per cent.

In these simple illustrations the direct effects of increased obstacles between producer and consumer are set forth in plain terms, so far as interchange with a distant country affects the conditions of a country circumstanced like our ideal Euphrasia. To apply the argument involving obstacles to other countries not so favourably conditioned as Euphrasia might favour the adoption of interchange between two or more distant countries, as effecting improvement in the condition of consumers in each country—but this improvement could only reach the highest possible quota for such a place where the exchanges are confined to the necessary products, which are either naturally easily produced beyond local needs, or in respect of products which are naturally deficient within its own border. In such case the exchange of the former by exports would have to be met with a similar value of imports of the latter. But even here the disadvantageous effects of obstacles are not a whit lessened. The disadvantageous effects of obstacles have to be endured so long as they do not outweigh the advantages of the desired exchanges.

Nay, there is one form of want—Food—which no obstacle can outweigh so long as the energies of the labourer in other directions remain unexhausted. The unfortunate country so circumstanced must of necessity effect exchanges with food countries, or perish as a community. Still more terrible is it for the masses of this country if it should happen that it lacks the natural or raw products upon whose manufacture the exchanges for the food of other countries depends.

In such a case the friction of obstacles (distance) between (1) producer of raw products (2), manufacturer, and (3), consumer—attains its maximum — notwithstanding that science and skill may have done, and are still doing, wonders by steam and other contrivances on sea and land to minimise its lowering influence on the amount of satisfactions proportionate to labour exerted.

The Economist may here exclaim : How does the Euphrasian argument from obstacles reconcile itself with such a case as the United Kingdom. He will no doubt proceed to show that no nation on earth has carried the method of interchange with other countries to so high a pitch as the United Kingdom. Her vessels are found laden with the products of exchange in every important harbour of every country.

Her aggregate wealth is the envy of nations, amounting to a sum something approaching £130,000,000 as a yearly income. Her external interchange trade amounts to 643 millions yearly, 362 millions being imports and 281 millions being exports. Her annual value of real estate alone reaches £196,000,000. Surely, he would continue confidently, this is the most complete vindication that could be given practically, that the nation which has the greatest amount of foreign interchange trade and, presumably, the greatest amount of obstacles—is also the nation which, by her great wealth, affords the greatest amount of satisfactions to divide among her consumers.

The answer to this supposed objection certainly involves many complex questions, but it may at once be affirmed that it does not in the slightest degree diminish the value of the argument from obstacles as applied to Euphrasia. In making this affirmation it is not denied that the wealth of the United Kingdom in *the aggregate* is unbounded, and no one can reflect upon her grand achievements in science, wealth, and progress, without admiration and pride. The skill and energy of her people are marvellous, and our admiration is not lessened, but increased, by the thought that her vast resources and enormous interchange of trade have been built up by her prodigious energy and industry in *spite of obstacles of every kind.* Her skill, daring, and enterprise have given her the command of important lands under every clime. This skill and enterprise, however, could not within her own borders increase, beyond a certain limit, the necessary supplies to meet her rapidly growing needs, as regards food and clothing for her people and raw products to supplement her needs for supplying manufactures in exchange for prime necessaries, failing which she could not support the lives of her people. It is necessity, therefore, which inevitably forced her to direct her industries in such a manner that her lack in food and other raw products at home should be purchased by a surplus creation of manufactures. Food, being one of the prime essentials to the life of each person, must be secured in sufficient quantity, or the lives of her workers cannot be sustained. A nation possessed of all the world's wealth of exchange could not preserve the lives of her people if this one form of wealth—Food—be lacking or insufficient. With such a nation—so unfavourably conditioned—her existence depends upon her power to command supplies of the food of other countries in exchange for such products as food-producing countries may think it desirable to take from her.

The food-producing countries may carry on this exchange as a matter of choice or preference; but with the food-requiring country the exchange must be effected—on the best terms possible—but if necessity presses hard, *it must be effected upon any terms forced upon her.*

Fortunately for such a country all lands capable of producing large food supplies are not in the condition of our ideal Euphrasia, and hence there is little danger of a stoppage of food exchanges for manufactures so long as the food-producing country is tempted by cheapness to buy those of the food-lacking country in preference to making them for herself; or of buying them from a rival manufacturing country on *still* more advantageous terms.

FREE TRADE.

A food-lacking country must therefore favour free interchange of trade, for it is necessary to her existence. A country with ample natural sources unutilised or partly utilised would only suffer a *temporary inconvenience* by the cessation of imports of foreign manufactures, and it is possible that this inconvenience which forced her to supply her own wants from sources and agencies within her own borders might result in increasing the amount of satisfactions for each consumer with an expenditure of a smaller amount of exertion on the part of each producer and distributor.

AGGREGATE WEALTH AND INDIVIDUAL WEALTH.

But let us again return to the outward indices of the prosperity of the United Kingdom. Admitting that she has great wealth in the aggregate, it does not necessarily follow that the share of satisfactions falling to the bulk of her people compare favourably with countries whose aggregate wealth is comparatively small. In point of fact any aggregate respecting the wealth of a country is a pure abstraction. It is as such enjoyed by no one. It is the share falling on the average to each individual which is the true indication of real wealth, or of the satisfactions enjoyed by the unit.

This is significantly demonstrated by contrasting two widely differing countries in respect of that abstract idea called national wealth :—

	Tasmania.	United Kingdom.
Area	16,778,000	... 77,800,000
Ditto per head of population	114·13	... 2·05
Aggregate earnings of wages class	5,519,340	... 800,084,000
Working class breadwinners, estimated	61,326	... 15,884,000
Ditto per head	£90	... £51
Average hours employed per week	44	... 55
Ditto per week	34s. 6d.	... 19s. 3d.
Average wages per hour ...	$9^{\cdot 40}$d.	... $4^{\cdot 20}$d.
Average cost of one quarter of wheat	32s. 6d.	... 32s. 6d.
Equivalent of ditto in true purchasing power, *viz.*, *hours labour*	$41^{\cdot 5}$ hours	... $92^{\cdot 9}$ hours

Thus it will be seen that notwithstanding the imposing effect of the vast aggregate wealth of labour in England representing over eight hundred million pounds sterling—the purchase of one quarter of wheat, the staff of life—demands of her workmen the expenditure of 92·9 hours time in labour, whereas in Tasmania the same amount of satisfactions can be gained by the expenditure of 41·6 hours of labour. That is, the English workman would have to work—if work could be placed at his disposal (in itself a greater difficulty)—123 per cent. more hours to attain the same purchasing power possessed by the Tasmanian workman, whose *aggregate wealth* only represents 0·69 per cent. of the corresponding *aggregate* in England.

This clearly proves how misleading are the effects produced by allowing the mind to dwell upon mere abstractions based upon aggregates.

THE EFFECT OF STRIKES OR A RISE IN WAGES IN FOOD-PRODUCING AND FOOD-LACKING COUNTRIES.

But the difference in the purchasing power of the English breadwinner is not the only disadvantage. Her purchasing power is also not merely limited by the extent of the market for her manufactures, but upon her success in underselling foreign rivals who are also by necessity compelled to exchange manufactures for the prime necessaries of raw products of food and clothing; and hence her success depends either upon her superiority in skill and local appliances, or in cheapness or extending the hours of labour. It is a necessity that a manufacturing country must produce cheaply, and necessity will force her to attain this end by extending the hours of the labourer without extra recompense, should other means fail her as a competitor for the bread and raw products of food-producing countries. Strikes and combinations among workmen are only of value to them within very narrow limits. For let us suppose that England's supremacy as a manufacturing country depends upon her present power to undersell rival countries to the extent of 15 per cent., it would then follow that any *nominal success* attained by the combined strikes of her workmen, thereby improving their hours of labour or rates of wages to the extent of, say, 16 to 20 per cent., would be altogether disastrous; for it would destroy the competitive power of England as a manufacturer for other countries than her own. But if England was thus shut within herself there would probably be no employment whatever, and no means of subsistence for perhaps 20 millions of her present population of 38 millions. This would be a terrible result arising out of the success of combined strikes among her manufacturing workmen.

That an increase of the cost of her products to the extent of what has been indicated is not a very improbable matter springing from strikes has been foreshadowed by the recent combination among English dock labourers, who succeeded in having their rate of wages raised 2d. per hour. As the average rate of workmen in England is only $4{\cdot}^{20}$d. per hour, a general increase of 1½d. per hour would raise the cost of wages $35{\cdot}^{7}$ per cent.; and as the price of labour is the chief item of cost in all manufactures, it is not improbable that the ultimate cost of her manufactures would be raised 20 per cent., thus cutting her off from her previous advantage, which enabled her successfully to outrival all other countries in supplying the external markets of the world with manufactures.

In countries where food and raw products is or can be produced far in excess of local requirements, the effect of prohibitive tariffs in raising local prices would not have a similar effect. If the cost of living would be *nominally raised* thereby, it would be exactly or nearly counterbalanced by a *nominal increase in earnings locally.* Thus, for example, if the consumer had to pay 20 per cent. extra for all articles of consumption it is probable that even this would not be disadvantageous; for it is almost certain that the true purchasing powers of labour—relative to staff of life—would be very little altered, as the *price of labour* would also tend to approach an increase of 20 per cent.

But there is one effect which this would have upon a food-producing country, which would show a decided contrast with a similar rise of wages in a manufacturing country such as England, *viz.*, it would draw to the former the manufacturing labourers of manufacturing or densely-peopled centres; for instead of cutting off sources of employment, as in England, it would of necessity require her to import *labourers* to produce those wants locally, or a great portion of them, which formerly had been supplied to her by the manufactures of *external* labour. That is, broadly, its main effect would be to increase the local *labour market* or widen the field for the employment of local labour. At first this would also have the effect of diminishing the aggregate extent of *external commerce;* but it need hardly be discussed, all things being fairly equal as regards natural sources, that the supply of exchanges by home products, instead of by foreign, is all in favour of diminution of *obstacles*, and therefore, upon the whole, advantageous. . . . This problem has already been worked out in the United States of America, and whatever the ultimate effects may be when local population approaches too close to her limits of natural powers for producing *food and necessary raw materials* for her own people, it is undoubted that 60 *millions* would not be profitably employed and well supported if it were not for her policy of favouring the creation of her own wants as far as possible by the energies of *local labourers.*

It must be granted, however, that the policy which is advantageous to a rich food and raw-producing country, such as America, would be annihilation to a country such as England, where the population by far exceeds her natural sources of supply as regards food and other essential raw products.

A country so circumstanced must maintain a Free Trade policy or perish. With countries thinly populated, possessing illimitable sources of natural wealth, including soil, climate, and all conditions favourable for the production of food and raw products in excess of local wants, it must inevitably follow that the tendencies and influences arising from the desire to extend the *local field of employment* must be in the direction of *Protection,* or restrictions upon foreign trade. It is the conditions of the various countries which determine *means* to ends. In one country the *means* is Protection, in the other Free Trade; but the *end* in both cases is the same, *viz., the best available mode of supplying the greatest amount of satisfactions to each individual (including local employment to the rising generation) with the least expenditure of individual effort.*

If Mr. Henry M. Hoyt, who has so ably defended the American policy of Protection, had premised that he was referring solely to countries rich in all natural sources—far surpassing the demands of all possible local requirements—we might agree with his ideal as regards the policy to be pursued, *viz.*:—"The nearer we come to organising and conducting our *competing industries,* as if we were the only nation on the planet, the more we shall make, and the more we shall divide among the makers. Let us, at least, enter upon all the industries authorised by the nature of *our* things. Thus we shall reach the greatest annual product of the industry of the society."

When, however, any country's population fails or is unable to cultivate 2·81 acres per head within her own borders the policy suggested by Mr. Hoyt must of necessity be abandoned in favour of Free Trade. This necessity—involving the population difficulty—is, however, an evil, and not an advantage to the masses.

RENT MONOPOLY.

Emotional and inexact writers, carried away by some foregone conclusion, or by the fascinating exaggerations of a certain literary style, are constantly blundering when they attempt to investigate the casual relations of complicated matters. Rent presents a fertile theme for mere emotionalists, yet no subject presents greater difficulties to the earnest and more exact investigator than that of rent, whether regarded as (1) a proper object to be included among *individual rights of property*, or (2) in its effects, in the opinion of some, in increasing by its amount the cost of production.

(1.) What is the peculiar claim upon land which, when used or let to a tenant, is called *rent*, and when occupied by the legitimate owner is in official assessment rolls termed *annual value*?

(2.) How has the owner acquired such a right to land which empowers him to monopolise its uses in any way not otherwise restricted by law, or to let it to another for an equivalent in value termed *rent*?

Perhaps the progress of property acquirement in a young colony affords the best means for giving a correct answer to these questions.

In Tasmania, for example, there is an area of 16,778,000 acres, of which, up to the present time, 4,572,649 have been converted by purchase or grant into private property, and whose annual value equivalent to rent is estimated at £860,555, or 3s. 9·16d. per acre. The remainder, representing nearly three-fourths of the whole, is still owned by the State. But this includes the land and *its improvements*. If we eliminate the value of buildings alone—which we could not put at a much lower figure than £584,000, *viz.*, 29,200 buildings, most habitable at £20—this leaves only £276,555, or a value of 1s. 2½d. per acre for lands and *other improvements*, embracing fencing, grubbing, clearing, burning timber and scrub, etc.

It is true that of the 4,572,649 acres private property only about 150,000 acres are under tillage, and about 410,000 laid in permanent grasses, fenced, cleared, or otherwise improved; this represents only 12·22 per cent of all private property.

Even if we suppose the 87·78 per cent. of uncultivated land to possess no exchange value whatsoever, and that the existing *rent* only bears relation to the 560,000 acres of cultivated land, then this ($\frac{276555}{560000}$) only provides 9s. 10½d. per acre as the proprietor's recompense for capital (the fruit of previous labour or service, paid for the *proprietorship*), and for the labour value expended in bringing the wild bush land of nature into a condition fit for the plough. Leaving out the loss to the owner expended in obtaining the *rights* of *proprietorship*, it follows that there is now only 9s. 10½d. per acre per annum of exchange value left to cover former outlay which, in a rough bush country like Tasmania, would hardly compensate the actual labour of the pioneer bushman in reclaiming it. Here, then, vanishes the last trace of the *element* in rent supposed to form an important proportion accruing to the landlord without the expenditure of labour.

But some may object on the ground that I leave out of consideration the *increment* from which favoured properties derive the benefit, in consequence of the enhancing effect of subsequent influences (not the proprietor's) as, for example:—

(1.) The establishment of a town or city continually raising the value of lands within or near its bounds.

(2.) The establishment of roads and railways* at the public expense—improving means of communication, and saving time and money in the transit of persons and products—and thus directly enhancing or diminishing the value of the property.

(3.) The limited nature of naturally fertile land.

Such enhancement, for the most part, I fully admit, is in itself an unearned increment, and cannot always justly (from this point of view) be claimed by the proprietor as a value produced by his individual services.

But it must also be remembered that this increment in the aggregate is already included in the £276,555 present value of aggregate annual rental of all cultivated lands.

If, therefore, the present annual value of land, with incremental value, does not cover the actual value of the original services in rendering it fit for tillage or stock, it follows either that the exchange *value* of the land, as a whole, has fallen below the original cost of services rendered to as great or to a greater extent than property value, as a whole, has been raised by the unearned increment. It becomes a fair contention, therefore, on the part of the proprietors of land to say that the possible loss from downward fluctuations in the exchange value of land would hinder the development of the occupation and cultivation of wild forest land, or obtain a lower value from purchasers if it were not for the hope that other influences—unearned increment, for example—gave promise, as in other speculations, that such possible losses might be compensated for by such possible gains; and we might also urge that if the community does not share in the gain of unearned increment it is compensated by its freedom from sharing the actual losses which are brought about frequently by external influences effecting a gradual or sudden depression in exchange value below the original cost of preparing the soil for tillage, or below the price of original purchase.

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* In a colony where these works are constructed at the cost of the public, it must also be conceded that the proprietor contributed his share of the general cost.

It is fairly consistent, therefore, to contend that so long as unearned increment does not exceed in amount the limits of a possible downward depression in *exchange value* (*i.e.*, risk of loss), it would be unjust to deprive them of the benefit of compensation in an upward direction (*i.e.*, chance of profit), and thus improvement in value, however caused, cannot rightly be claimed by the community as an *unearned increment* until its amount, as a whole, exceeds the original cost of services in converting the original land to the condition necessary to the uses to which it may now be devoted.

MONOPOLY OF THE GIFTS OF NATURE.

But, say others, have you forgotten the free gifts of Nature—the oxygen, carbon, rain, and the forces of life—called into play by man's industry, increasing his original stores every year forty, fifty, and a hundredfold; these forces silently working, whether the proprietor sleeps or wakes, are surely embraced in the products reaped. Most certainly. Man's labour would be of no avail without these natural forces. But who reaps the benefit of these general gratuitous services? Most clearly it is the consumer. The free forces of Nature common to all lands are not produced at the expense or by the labour of the producer, and it would scarcely ever occur to him to introduce it as a possible ingredient in the selling value. It no more can enter into the selling value of common terrestrial products than can the value of the free winds of heaven enter into the merchantman's freight charges. In truth, the selling price of products—such as wheat, for example—is not now determined by the producers of any one country; nor by the immediate actual cost of production defrayed by any particular producer; nor by the greater or smaller natural fertility of the soil of any one place or country.

It is not now farm against farm, but terrestrial region against terrestrial region, in which natural agents, such as *climate* and *largeness* of cultivable area play a greater part than human skill or even richness of soil.

The aggregate quantity produced in relation to present demand is the only determining measure of selling price. When supply is much above demand the producer must often sell under cost price. When supply falls short of demand the profit is still measured in the same manner without reference to immediate cost of production. Competition forces all producers to give the consumer the benefit of all gratuitous aids—whether natural or artificial—that are free to all other producers, and the only effect of actual cost of production is that it determines the extent and quality of the lands which are best capable of promising success in the competition for supply. It also spurs industry and invention in the direction of lessening cost, all of which benefits inevitably are reaped by the community. No gratuitous element entering into products can ever form part of *exchange price* so long as there are many competitors and free competition. In the case of the products of agriculture, too, there is the greatest possible security against the arbitrary acts of monopolists in the hugeness and the universality of producing operations which can be focused at any point of demand in the globe by the mighty steamships on the ocean highway, and which would require omnipotence and omnipresence to monopolise.

If any one country had a monopoly of the production and supply of an important product of the land, such as wheat, I frankly admit that the owners of more fertile parts would reap the sole advantage of this limited gratuitous gift of Nature (the one rent of Political Economists), provided that in the acquirement of these more valuable parts the present or original possessor had not given the state or community an equivalent in purchase value; but this monopoly of good lands, while securing a better return locally as compared with poor lands, may not secure as much additional profit as the difference in the fertility of rich and poor lands would seem to indicate.

The world's supply, if not artificially barred or shut out from any country, determines the actual price of corn, and it is significant that America, with her bonanza method of farming on a scale far grander than is possible in England, is enabled, with a much lower natural yield per acre, to grow grain cheaper, and in much larger quantities than in England; and consequently she regulates the price of corn in England more by her methods and scale of farming than by higher fertility of soil. The nature of the season's rainfall, too, falling indifferently, and often irregularly on good or bad tracts of lands, and sometimes restricted in sufficient quantity for produce, a high yield to particular provinces further breaks the influence of fixed fertility of soil in any one country as a regulator of price. The mere difference of fertility of soil of any one country may not, therefore, be the dominating influence in determining price to consumer, and hence the consumer may even have the advantage of the gratuitous influence—a more fertile soil—in reducing the general average of the price of corn.

In the century ending 1888 it is estimated that the population of Europe and North America increased from 150 to 470 millions, that is, 180 per cent. This must have correspondingly increased the demand for food and the unearned increment of land. Notwithstanding this, such were the mighty effects of steam and electricity introduced, adding to the effective force of man's labour and time, that the supplies were multiplied at a greater rate, and relatively at a much smaller expenditure of man's labour.

ABOLISH THE MIDDLEMAN AND THE MONOPOLISER OF NATURAL WEALTH.

Many are of opinion that the consumer of wants would be greatly benefited if he were brought more immediately into contact with the producer without the intervention of the middleman. No doubt some of the latter, where circumstances favour them, succeed in monopolising a larger share of profits than he is entitled by his services, but the evil may well be left, in the long run, to be remedied by the action of rival competitors for custom. True the co-operation of consumers may successfully employ salaried agents for performing the same services, but this is not abolishing the middleman, but rather controlling his charges by converting him from an independent dealer or agent into a salaried servant. It is not always possible, however, for consumers to secure wise and trustworthy agents, and there are many advantages valued by many consumers profitably risked by energetic, independent middlemen which would not be safe to commit to a hired servant, and hence it seems improbable that association, often necessary and successful, will entirely occupy that division of the social exchanges of services.

Not a little of the objection to middlemen, however, arises from the misconception that the wealth earned by middlemen, professional men, and the rich, is equivalent to wealth individually consumed by them.

This naturally leads on to

DISTRIBUTION AND CONSUMPTION OF WEALTH.

There are many fallacies current with respect to the distribution of wealth. If all the enormous wealth year by year created by stored fruits of previous labour (capital), current labour, and the gratuitous forces of Nature, were directly devoted to consumption or enjoyment, no doubt the proportion per head allotted to the industrial labourer would be small indeed in comparison with the rich. Indeed, it is urged by Lange [1] that it might be better for society generally, as well as for the rich industrial chiefs, that if all those who have acquired a more than moderate income were to retire from business life, and henceforth devote their leisure to public affairs, to art and literature, and in fine to a cultured enjoyment of life upon moderate means*, "not only would those people lead a more beautiful and worthier existence, but there would also be secured an adequate material basis to maintain permanently a nobler culture with all its requirements, and thus to give a higher content to our present epoch than that of classical antiquity." As it is, he charges not inaccurately the few colossal capitalists and industrial chiefs of the present age with miserly abstemiousness as regards the proportion of the wealth gained by them which they devote to immediate personal enjoyment and consumption. He adds:—"It is true that forces on forces are created, new machinery continually devised, new means of communication; it is true that the capitalists, who have the means at their command, are ceaselessly active in creating, *instead of enjoying, the fruits of their toil* in dignified leisure; but, nevertheless, the constantly increasing activity aims directly at anything rather than the furtherance of the common weal (?) . . . The great interest of these times, however, is no longer, as in antiquity, *immediate enjoyment*, but *the accumulation of capital.*"

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[1] * Lange's "History of Materialism." E. C. Thomas' translation. Vol. iii., pp. 237, 238, 239, 241.

Again he states (p. 241):—"We live, in fact, not for enjoyment, but for labour and for wants; but amongst those wants that of pleonexia is so over-bearing that all true and lasting progress, all progress that might benefit the mass of the people, is lost, or, as it were, gained only incidentally."

If this be a true picture, and it must be confessed it is to some extent borne out by experience, we may ask, Who derives the benefit of the capitalised wealth? This requires careful analysis; for the conclusion to be drawn as regards the public weal may be widely different from that indicated by Lange.

We may truly premise, in the first place, that capital in the hands of the rich, in so far as personal consumption is concerned, is as much a *tool of trade* as is the *plough* to the farmer. By its means he sets in motion the wheels of many industries, and so enables the smaller capitalist of muscular services to exchange his capital for primary wants, necessary minor tools of trade, and such comforts as his varying rates of profit may afford. The rich capitalist in like manner, but with much larger profit, reaps the reward of his ventures. But there is this important difference: The rich capitalist cannot or does not abstract from his profits the *same proportion* of earnings towards his personal wants and enjoyments as the workman does. On the contrary, what he can directly consume personally of the said primary wants and comforts is limited by the same natural law as his humblest workman, and the necessities of tear and wear in his machine (*capital*), or the passion or necessity to increase the number and power of his machines, and to keep them ever at work, *abstract the greater portion of his increasing or decreasing profits*. In consequence of this inevitable tendency it is really a difficult question to say which of the two—rich capitalist or workman—personally consumes the largest portion of products created each year for actual consumption and enjoyments. It is almost certain that as regards some of the most valuable necessary natural products the balance would be in favour of the workman. What immense capital is devoted to making and working or developing railways, steamships, sailing vessels, telegraph lines, machinery of all kinds agricultural, farms for food and various textile products, pastoral farms for the produce of animal meal and materials for clothing, houses for shelter of men, animals, and products.

What is usually termed "The Enormous Accumulations of Wealth in our Times," "The Riches of Capitalists," are really those *tools or instruments* themselves. But the owner no more *consumes or personally enjoys* this form of *commercial wealth* than does the poorest labourer who toils upon these machines and instruments of his employer. This is seen at once by asking for what purpose is it that so much of the vegetable and mineral products of the earth, and so much of the former energies and labours of man have previously been saved, abstracted, or diverted from former possible powers of consumption and personal enjoyment; and for what purpose is it that capitalists and workmen alike devote such a large portion of their present services in fresh creations, and to the repairs of the consumption (tear and wear) of these very machines which do not themselves enter into their personal consumption or enjoyment, although they nominally make up the greater part of the so-called accumulated wealth of capital? The answer is very simple. Their sole end is the production, transport, distribution, and protection of man's primary wants—Food, clothing, shelter. Luxurious articles of consumption are insignificant as compared with the necessaries.

It is mainly for food and clothing, therefore, that all this vast machinery of the capitalist has been created and set in motion by the savings of *previous efforts.* How much, then, of this ultimate fruit of the combined result of the capital of machines and instruments, the forces of Nature, and men's labour, is actually absorbed or consumed by the rich capitalist, as compared with the poor servant or artisan?

Let us see:

(1.) The human body can only consume and assimilate a certain quantity of food per day. The old, sickly, and very young cannot consume or assimilate so much as the strong, healthy persons of youth and prime of life. Health and hard physical employment cause the body to burn more food just for the same reason as greater energy exhausted by a steam engine demands a much higher consumption of fuel.

This is the reason why an average, strong, healthy navvy can and does consume a much greater *quantity* or weight of food in the day than the less robust city clerk or the brain-worried financier. Similarly, it is safe to affirm this of all persons who are obliged to put their bones and muscles into greater activities than their brains, and hence it is reasonable to state that man for man the average food consumed and enjoyed during the life of a labourer is much greater than that personally consumed by those whose physical exertions are smaller, as in the case of clerks, shopkeepers, teachers, professional men, bankers, and rich people. As the production, transport, and distribution of this food for consumption is by far the greatest object for which all the capitalist's savings and machinery have been put in motion, and must continue so, it follows that at least in this respect the wealth of food, the chief primary want; wealth in highest utility as well as their wealth of exchange, the end and aim of the greater part of all wealth in capital, is more largely distributed among and consumed by the poorer classes than is the case with the rich. It is true luxurious foods, having a relatively higher *price*, are to be found more on the rich man's table; but the limits which determine what the rich man really can consume of common and rare substances must again be reckoned with. When we regard the cheap foods now found on the humblest cotter's table, and much of which, because of former rarity and price (tea, coffee, spices, etc.), are still termed luxuries, we can well perceive the utter insignificance of the limited quantities of *rare* food monopolised by the rich, more *costly* because *rare;* not because of superiority, or because in its production it originally demanded more of the *gratuitous forces of Nature*, the devotion of more *capital*, or the expenditure of more *labour*—but mere variety—one of the chief characteristics of that part of *nominal exchange wealth termed pleonexia.*

The next item, clothing, has to be considered, and here again it may be affirmed that the tear and wear of hard work of the labourer demand that his clothing should be stronger. He, as a rule, therefore, personally *consumes* a greater weight of the produce of the sheep and the cotton plant than the rich man, and however dirty and ill-looking they may seem from the nature of the labourer's employment, the production is as great a tax upon the land and the forces of nature; upon the means of transport, upon the capitalist's looms, and upon manufacturing labour, as the clothes of his employer. The silks and satins, like rare foods, are more beautiful and *rarer;* but their high price is on account of *rarity*, not because they are more useful. Indeed, they are for the real purpose of clothing far inferior in general utility to the commoner cheap woollen and cotton fabrics. The same reasoning is applicable to the remaining portions of the real wealth of primary wants and ordinary comforts, all going to show that underneath the *nominal* proprietorship of the means which *produce* consumable wealth, the share allotted and falling to the humblest classes is greater than is generally supposed.

If the material comforts are, as shown, most fully distributed according to wants, and not to relative powers of purchase, it may also be shown that the highest forms of culture and enjoyment are within the reach of all.

We have but to refer to cheap periodicals, cheap editions of valuable works, newspapers; the stage, music, fine arts. In fact, it is notorious that the more elevated and healthful amusements are obtainable at the least cost, and, owing to the spread of education, it is curious to observe that the children at public schools are now better trained in reading music at sight than are the children of the wealthy in the higher academies.

If it were possible for the skilled craftsman of the present day to compare his condition with that of his representative of the last century, or even with the rich of the same period, he would realise that, whatever misery or difficulty still exists among us, the condition of the masses is vastly superior; and this improvement could not possibly have taken place if the rich in past times had *personally consumed their yearly profits* in the *same proportion as the poor;* for if they had the capital, now engaged in meeting the demands of increasing millions of men would not have been saved, and further increase in population would be impossible.

CAPITAL AND WAGES DIFFICULTY.

It may seem a bold and hazardous thing to propose new definitions for terms so frequently defined by the ablest minds, but as in their application it is undoubted that in the many definitions of *capital and wages* each varies considerably from the other; and as most of them fail more or less in consistency and relevancy with the matters upon which they are brought to bear, it is not unreasonable nor over-presumptuous on the part of anyone to attempt the solution of the difficulty, so long as these difficulties are also fairly appreciated.

The expansion or limitation of the meaning of the words, Capital and Wages, I am of opinion, would not be the source of so much confusion if it were more firmly grasped by each one that the terms belong to two important and distinct categories; the first either wholly or partly related to the agents or powers involved in the *Creation or Production of Wants in Exchange;* the second either wholly or partly related to the *Appropriation of the Wants of Exchange Produced.*

Instead, therefore, of dwelling upon the contradictions involved by the inconsistent use of these terms, it may serve a good purpose if we discuss *ideas* rather than *terms* before involving the issues with a fruitless logomachy regarding unstable definitions. First, let us honestly try to bring under the first category all the elements or ideas that are necessary to be reckoned with in making it complete, *viz.*:—

> What are the necessary powers and forces now used in the effectual production of wants *in exchange*.

To realise these powers and forces it will admit of clearer apprehension if they be classified in tabular order thus :—

(A.) Agents or Powers Necessary to be Employed in the Production and Preservation of Wants in Exchange.

a. Labour (Present Labour).	1. Of *highly-skilled minds* in the determination of the *modes* in which labour may be made most productive; labour thus devoted may be the means of adding from two to many times the effective power of the physical force of the labourer of mere brute force. *Types:* The inventor of spinning jenny, steam-engine, director of operations, etc.
	2. Highly-skilled hands. *Types:* Mechanic, carpenter, weaver.
	3. Ordinary skilled hands. *Types:* Navvy, messenger, ploughman, shepherd.
b. Indirect Fruits of Labour and Skill (Anterior Labour of Bastiat).	Products of food, clothing, shelter, etc., on hand in smaller or greater proportions by different persons; the fruit of previous labour and other forces saved (1) partly by greater individual economy, or abstemiousness in the consumption or enjoyment of wants previously earned; or (2), the saved and preserved surplus of previous earnings, due to the products of previous labour and skill being much greater than the power to reasonably consume or enjoy.

c. Indirect Fruits of Labour and Skill (Anterior Labour of Bastiat).	The possession of lands, mines, costly machines, railways, canals, ships, buildings, instruments of all kinds that have or may be *bought* or *sold* by the accumulated *previous or current savings* of skill, industry, or common physical labour.

If capital, as a term, be confined to *b* and *c*, there could be no objection if it were not assumed afterwards that these alone formed the whole of the forces necessary to produce fresh wants in exchange in sufficiency for all. Similarly, there would be no objection to confine the term capital to labour, if it were not ignored in after applications that the important portions, *viz.*, Indirect Fruits of Previous Labour and Skill or Anterior Labour (*b c*) are also necessary for the *effectual production of the wants of all*, and that those gained by right of previous savings are not generally distributed possessions.

We come now to the second great category:—

(B.) Modes of Appropriation of Wants in Exchange Created or Produced, or About to be Created or Produced.

Mode.	
a. (By Wages or Salary.)	Labourers or poor capitalists share in respect of personal services *mainly*.
b. (By *Commission, Interest Rent, or Income.*)	Employers or possessors of a more than ordinary share of the equivalents of previously stored labour and skill—rich capitalists—obtained *mainly* from the possession of a larger share than ordinary of the actual fruits, or the equivalents of previously stored labour and skill.

From this analysis, which is sufficiently comprehensive, it would appear that labourers are simply *poor capitalists*, and employers and wealthy people are *rich capitalists;* that both forms of capital are necessary to the production of fresh wants for all, and that both—whether as wages or salary, or whether as commission, interest, rent or income—derive their share of these wants by the aid of the combined action of the two groups. In this sense it is no more true or false that wages are derived from *capital*, than that commission, interest, rent, or income is derived from *capital*. If this view of the case be correct, it would seem to appear that certain Economists, as well as their critic, Mr. Henry George, are wrong,* for if the former may be justly accused of ignoring B *a's* part in the production of wants in exchange (in their wages fund theory), the latter errs quite as much in ignoring the vast part which the increasing store of previous savings, or more or less permanent creations (anterior labour), represent in the combination necessary to produce in sufficiency for all the ordinary *wants of exchange of human beings.*

IMPROVEMENT IN THE CONDITION OF THE INDIVIDUAL LARGELY DUE TO THE SAVINGS OF ANTERIOR LABOUR (CAPITAL) SKILFULLY APPLIED AS INSTRUMENTS AIDING PRODUCTION.

This solution of the vexed problem of the so-called "Wages Fund" is, moreover, in harmony with all related facts, and it clearly establishes the important truth that it is to preserved previous savings (anterior labour) skilfully applied, that the powers to further increase of production *per head* is mainly secured; for if the increase in appropriation to necessary machines and instruments be only proportionate to increase in mouths to be fed, there would be no improvement in the appropriation of wants per individual, even though "each mouth" be accompanied by "two more hands," as urged by some. It follows, therefore, that if the individual necessary wants be now better supplied than in former times, it must either be due to relative diminution of the mouths to be fed, or to the multiplication of productive power (anterior labour) largely due to the great advances made in recent years in the power which man has obtained over the forces of Nature. As it is undeniable that population has largely increased since the beginning of the eighteenth century, and as it is also demonstrable, notwithstanding the great simultaneous increase in population, that the supply of wants per head, rich and poor, have also materially improved, while the hours of labour have been shortened, it follows logically that this improvement, in the aggregate and per head, is entirely due to the vastly increased productive power obtained through a greater knowledge of Nature's forces—more especially in the uses of steam and electricity. The contrary allegation by Mr. Henry George and others has no support from reason or facts.

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* The admirably expressed views of Bastiat, however, are in entire accord with these views.

Thus Bastiat writes (p. 48, "Wages—Harmonies of Political Economy"):—"As capital is nothing else than human services, we may say that *capital* and *labour* are two words which in reality express one and the same idea; and consequently the same thing may be said of *interest* and *wages*. Thus, where false science never fails to find antagonism, true science ever finds identity.

"Considered, then, with reference to their origin, nature, and form, *wages* have in them nothing degrading or humiliating any more than *interest* has. Both constitute the return for present and anterior labour derived from the results of a common enterprise. Only it almost always happens that one of the two associates agrees to take upon himself the risk. If it be the present labour which claims a uniform remuneration the chances of profit are given up in consideration of *wages*. If it be the anterior labour which claims a fixed return, the capitalist gives up his eventual chance of profits for a determinate rate of *interest*.'

It is clear, therefore, that the greatness or smallness of accumulated wealth is not necessarily an index to the presence or absence of individual comfort and happiness, but rather both depend upon the relative proportions which the total wealth and total population bear to each other.

From this it is easy to show that the chief source of misery and discomfort—or the diminution of necessary supply of wants per head—is mainly due to the tendency of population, in times of distress, to increase in a greater ratio than the powers of production.

The extravagant statement of Mr. Henry George, that "there is nowhere any improvement which can be credited to increased productive power," is too absurd, perhaps, to require serious consideration. Yet it may be well to show by a simple illustration its utter fallacy.

Let us take one of the most important wants of man, necessarily consumed alike by rich and poor, *viz.*, *common water*. Although in natural reservoirs or channels, as in springs, lakes, and rivers, it is generally a gratuitous gift of Nature to all men, it has to be transferred to points of consumption; and although the gratuitous element never enters into *exchange price*, it is generally a marketable commodity in large centres of population where a large daily supply is absolutely necessary. The element which here forms price is *labour of transfer.* The labour of transferring water by primitive means is great, as one gallon weighs 10lb., and if the distance be considerable both *time* and *muscular powers* of labourer must be consumed, and, therefore, the carrier must earn the equivalent of such *time* and *labour* as may be expended in this most necessary service. It is true water, for the support of a few individuals, may be supplied at a minimum of the expenditure of *time* and *labour;* for their habitations might be fixed contiguous to the natural supply; but for large towns this, for the most part, is quite impracticable. In the latter case water supply would fall into one of the most important divisions of marketable labour, and the price of water to the consumer would be determined by the present time and labour bestowed by water carriers engaged in the service, plus the proportion of cost and maintenance of equipment necessary—(anterior labour).

Now, if we were to confine attention to the *producer* (only about 44·2 per cent. of living persons are producers of marketable wants), we would never perceive the full significance of the statement *that the greater the proportion of skilfully applied previous labour or service (tools, instruments, appliances, etc., or anterior labour) introduced as auxiliaries to present labour or services, the greater is the power of production and supply, and the smaller is the price of the product.*

But if we bear in mind that all persons are *necessarily consumers*, we can at once perceive that *abundance* and *lessened cost* of primary needs, consumed alike by rich and poor, by producers and dependants, are real benefits in which *all* must equally participate. If it can be shown, then, that the statement respecting the introduction of anterior labour is correct, it follows unmistakably that Mr. Henry George's statement is contradicted in the experience of all men as *consumers of marketable wants.*

The City of Launceston contains about 15,000 inhabitants. Each person consumes on an average at least 20 gallons of water per day = 200lb. weight. Thus the population consumes each day at least 1,342 tons weight of water per day, or 488,840 tons per year, and each person consumes 7,300 gallons per year.

The transit of this 488,840 tons over 13 miles from source is at present easily effected by permanent waterways, iron pipes, reservoirs, etc. (*representing anterior labour*), in conjunction with a staff of men engaged in the maintenance and working of the water supply (*representing present labour*), and there is ample power (potential) in the store of existing *anterior labour* to double the supply, if required, without any addition to cost.

Now, the exchange value of anterior labour and present labour, combined in effecting this service each year, is estimated to be £68,243 and £2,133 respectively, or about £32 to £1.

The only way to measure the true value of the benefits effected by the direct influence of anterior labour as an auxiliary to present labour, is to try and estimate the number of men required to effect the same work of transfer, *viz.*, 488,840 tons per year a distance of 13 miles by more primitive means. It is impossible for men to do any part of this work without *some anterior labour* in the shape of instruments; but if we reduce the latter to the most simple form, it will be sufficient to demonstrate the enormous advantage gained by every accession to the power of anterior labour. Let us suppose, therefore, three modes of transfer:—

(1.) The primitive mode by pails of 2-gallon or 20lb. capacity, requiring 5 men and 10 pails per day for carrying one day's supply to each person, *viz.*, 20 gallons or 200lb. weight.

(2.) One man and a horse and water cart effecting the transfer of 224 gallons per day.

(3.) A system of pipes and waterworks, with a staff of men to maintain and work the system, capable of transferring at least 1,342 tons of water per day, *i.e.*, 300,000 gallons.

We may now, in a tabular form, compare the effectiveness and cost of the three modes as follows. To supply 15,000 persons:—

	1st Mode.	2nd Mode.	3rd Mode.
Water transported 13 miles per head of population per day... ...	20 gallons	20 gallons	20 gallons
Number of men required per day...	75,000 or 3261	1,342 or 58·35	23 or 1
Cost of present labour service per year ...	£6,844,875 or 99·73	£122,290 or 64·57	£2,133 or 3·03
Value of instruments—Anterior labour ...	£18,750 or 0·27	£67,100 or 35·43	£68,243 or 96·97
Cost of ditto per year ...	£1,125	£4,026	£4,094
Total cost of transit to consumer per year ...	£6,844,875	£126,316	£6,227
Cost per 100 gallons ...	£6 10 0	£0 2 3½	£0 0 1$^{\cdot 36}$

It is here clearly demonstrated that by the accession of anterior labour, or the fruit of applied previous labour saved from personal consumption, and skilfully applied in accordance with the knowledge which man has gained with respect to natural laws, the effective power of each man's labour is multiplied 3,261 times, and the cost to consumer is reduced thereby to about $\frac{1}{1100}$th of that which it would cost if the proportion of anterior labour was at a minimum.

That is—when in the combined service of anterior and present labour, anterior labour only represented 0·27 per cent. of the combined service—the cost of water would be £6 10s. per 100 gallons to consumer; but when the proportions were reversed, and anterior labour represented 96·97 per cent. of the combined service, the cost of water would be reduced to 1$^{\cdot 36}$ per 100 gallons. It will readily be perceived, therefore, that the mere accompaniment of "two hands to each fresh mouth"* is insignificant as a force to effect improvement in the condition of the individual consumer of needs without a corresponding gain in anterior labour.

Why the present population of the United Kingdom and her colonies do not individually perceive the full benefit of the immense addition made to the store of anterior labour now used as an important auxiliary to the force of present labour, is not because of a failure in the production or in the distribution of the products or wants created, but primarily because the numbers of consumers of wants have kept pace hitherto with the increased producing power.

The individual does not necessarily benefit by the aggregate increase in production, as it depends upon the proportion which consumers bear to aggregate production. Thus:—

AVERAGE INDIVIDUAL SHARE OF PRODUCTS.

Let A=Aggregate products created by anterior and present labour.
C=Number of consumers.
P=Average proportional share of products falling to each individual.

Then $\frac{A}{C}=P$

It follows, then, that P will only improve so long as A continues to increase faster than C. The aggregate of A, however large, is of no account. It is the proportional relation to C which determines increase or decrease to P.

DENIAL OF COMPARATIVE PROGRESS IN MODERN TIMES DUE TO INCREASED PRODUCTIVE POWER.

"THE RICH ARE BECOMING RICHER, AND THE POOR POORER."

There is nowhere any improvement which can be credited to increased productive power.

The tendency of what we call material progress is in nowise to improve the condition of the lowest class in the essentials of happy human life. Nay . . . it is to still further depress the conditions of the lowest class.—"Progress and Poverty."

Of all the mischievous and erroneous statements current, perhaps these are the most notable. The statements imply that the relative state of rich and poor were formerly more equable, and that the working classes, or the lower zone of them, have not benefited by the introduction of steam and electricity, the occupation of vast new virgin lands, and by manifold inventions and improvements in labour-saving machinery, and in knowledge during the present century. It would be nearer the truth to say that, owing to increase in productive power, at no time in human history has the condition of the vast masses of skilled and unskilled workmen been so highly raised materially, intellectually, and socially. No one who has studied the writings of one of the ablest living authorities on this subject—Robert Giffen, President of the Royal Statistical Society of England—can help admitting that the humblest workmen of the present generation in civilised countries have marvellously improved their condition as compared with any known period in past history.

Material improvement, unfortunately, cannot eradicate all evils so long as we have those who are vicious, idle, and improvident, and the fruit of these evils must ever fill our records with statistics of crime and pauperism. Paradoxical as it may appear, it is in itself a grand index of moral improvement in our modern civilisation that we are able to refer to State-supported paupers, even although this benevolence may itself be the fruitful cause in time of adding to our social difficulties.

To state, however, or to imply that pauperism is proportionately greater now than when productive power was much less, is contrary to reason and fact.

The chief advantages of the present century in Europe and in English colonies are, that owing to the wonderful progress made in means of communication, in knowledge, and in labour-saving machinery, the masses of men

(1.) Are better fed, clothed, and housed than formerly, and are almost free from the terrible periodic famines which were so common in the four preceding centuries, and which still afflict the masses in India nearly every third year.

(2.) Are able to obtain primary wants, and even luxuries, with less hours toil.

(3.) Education and luxuries are now more diffused among the wage-earning classes than among the ruling classes two centuries ago.

(4.) Freedom and privileges, social and political, are immeasurably greater than in former times.

(5.) Notwithstanding that within the same area (United Kingdom) the wants of 37 millions have to be supplied, instead of 2,300,000, as at the close of the fourteenth century, and about 7½ millions at the beginning of the eighteenth century, these wants are now supplied much more certainly and in much superior quantities per head.

(6.) Life of each individual on the average is greatly prolonged, owing to improvement in hygiene, social habits, and in the improvement in material condition.

(7.) There is a much smaller mortality per 1,000; pauperism and crime is greatly reduced proportionally, and the effective power of labour is immeasurably superior.

PAST AND PRESENT CONTRASTED.

Therefore, whatever evils remain they may still be consistently admitted without denying the great comparative progress made generally in the age in which it is our good fortune to live. If we could really picture to ourselves the actual condition of society in former times, all doubts regarding progress made in recent times would be speedily set aside.

Let us for a moment take a glimpse into past history, as revealed to us in the pages of Hallam, the historian. Passing over the Dark Ages, when the husbandman was either degraded to menial slavery by brutal predatory lords, or, what was little better, was afforded such miserable tenure of villenage as the feudal lords were pleased to allow, we find the ruling classes themselves brutal, poor, and ignorant. Thus Hallam writes of the fifteenth century:—[1] "It is an error to suppose that the English gentry were lodged in stately or even in well-sized houses. . . . A gentleman's house, containing three or four beds, was extraordinarily well provided; few, probably, had more than two. The walls were commonly bare, without wainscot or even plaster. It is unnecessary to add that neither libraries of books nor pictures could have found a place among furniture. . . . No mention is made in inventories of such conveniences as chairs or looking glasses. Cottages in England at this time seem to have generally consisted of a single room without division of stories. Chimneys were unknown."

Even at the close of the seventeenth century the progress made was comparatively small. Draper states:—[2] "For a long time London had been the most populous capital in Europe; yet it was dirty, ill-built, without sanitary provision. The deaths were one in twenty-three each year;[3] now, in a much more crowded population, they are not one in forty" (one in fifty in the year 1886).

Much of the country was still heath, swamp, and warren. Nothing more strikingly shows the social condition than the provisions for locomotion. In the rainy season the roads were all but impassable. Through such gullies, half filled with mud, carriages were dragged often by oxen. . . . If the country was open the track of the road was easily mistaken. It was no uncommon thing for persons to lose their way and to spend the night out in the air. Between places of considerable importance the roads were sometimes very little known, and such was the difficulty for four-wheeled carriages that a principal mode of transport was by pack horses, of which passengers took advantage by stowing themselves away between the packs. The usual charge for freight was 15d. per ton per mile. The country beyond the Trent was still in a state of barbarism, and near the source of the Tyne there were people scarcely less savage than American Indians, their "half-naked women chanting a wild measure, while the men with brandished dirks danced a war dance." At the beginning of the eighteenth century even, the only press in England north of the Trent was at York. Social discipline was very far from being of that kind which we call moral. The master whipped his apprentice, the pedagogue his scholar, the husband his wife. . . . It was a day for the rabble when the culprit was set in the pillory to be pelted with brickbats, rotten eggs, and dead cats; when women were fastened by the legs in the stocks at the market place, or a pilferer flogged through the town at the cart tail. . . . To a debased public life private life corresponded. The houses of the rural population were (chimneyless) huts covered with thatch; their inmates, if able to procure fresh meat once a week, were considered to be in prosperous circumstances. One-half of the families in England could hardly do that. Children six years old were not unfrequently set to labour. In London the houses were mostly wood and plaster, the streets filthy beyond expression. There were no lamps. . . . As a necessary consequence there were plenty of shoplifters, highwaymen, and burglars."

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[1] "Hallam's View of the State of Europe During the Middle Ages." (Murray and Son, London, pp. 779, 781).

[2] "Draper's Intellectual History of Europe," vol. ii., pp. 238, 239.

[3] *i.e.*, 43·48 per 1,000, or higher than the birth rate.

No earnest and dispassionate person can contrast the conditions of the past with those of the present without frankly acknowledging the great progress among all classes, including the lowest in the scale; and further, that were it not for the vast increase in productive power the 30 millions of souls added to the population of the United Kingdom since the beginning of the eighteenth century would not have been called into existence. Misery and death would have arrested population at the limit of its old lower productive power, just as it has in all times prevented population from passing beyond the productive power of the respective times and places. Nay, no reasonable mind can for a moment doubt that the extra 30 million souls—with wants supplied more effectively than were the 7 millions at the beginning of the eighteenth century—is in itself the best proof that can be conceived of the beneficial influence exerted by the knowledge which man has gained over the forces of Nature since that time. Indeed, so palpable must this appear to any thoughtful mind that he or she would readily assent to the proposition that increase of population is possible only so long as the productive power makes a corresponding advance. When it becomes stationary population must become stationary; and that means intense competition for primary wants of existence, resulting in misery and starvation to the weakest, and indicated most infallibly by a sudden rising of the death rate to, or even above, the birth rate. These inevitable consequences will be more fully discussed hereafter under the heading "Population Difficulties." In the meantime, instead of making idle assertions, let us contrast the present with the past as regards the comparative progress made in population, and in material and social condition.

This can best be realised by tabulating for distinct progressive periods, statistics bearing upon population, crime, pauperism, effective purchasing power of the labourer in relation to primary wants and comfort. The condition of the United Kingdom since 1541 affords the best index of comparative progress.

COMPARATIVE EFFECTIVE PURCHASING POWER OF LABOUR.

Much information of value is lacking in the earlier periods referred to, but what is lacking would tell all the more in favour of the condition of the labourer in existing times:—

Estimated Population.		Average Increase Per Year in Population.	Average Price of the Quarter of Wheat.	Average Price of Wages Per Week.	Effective Power of Labourer in Purchasing 1 Quarter of Wheat.	Death Rate Per 1,000 Persons.	Paupers Per 1,000 Persons.		Crimes Com'td for Trial Per 1000 Per.
Year.	No. Pop.	About.	s. d.	s. d.	Days' Labour. No	—	Able-bodied.	All.	...
1400	3,300,000	..	...	...	...	...	...	...	...
1541-82	...	...	13 10⅓	5 1⅓	16·30	...	...	...	...
1583-1642	...	...	36 1	5 4⅓	40·28	...	...	...	...
1643-1702	7,500,000	(since 1,400) 14,000	41 11½	8 0¾	31·09	40	...	...	...
1801	16,237,300	87,370	...	...	...	...	...	...	...
1831	24,392,485	271,000	...	...	...	22·0	10·9	19·0	...
1850	...	...	...	...	...	21·6	8·0	17·0	0·31
1887	37,091,564	449,000	34 9	30 5	6·86	19·0	3·7	12·9	0·49
AUSTRALASIAN COLONIES.									
1887	3,551,751	...	33 10	53 7	4·34	...	...	...	...

The few figures in the preceding table tell a significant tale. Of course, it would be alleged by all who had preconceived notions that rates of wages and prices do not always reveal the effective power of the labourer to command primary wants. But no index of this relative power can be so satisfactorily shown than by reference to the relative purchasing power of the labourer as regards the staff of life. Whatever qualification may be urged, it is undoubted that the purchasing command of bread is the most powerful index to purchasing command over other wants.

Now, when it is shown that the average weekly wage of the wage-earning class at the present time, by the expenditure of 6·86 days' labour, commands as much power in purchasing one quarter of wheat as it would take the same class

16·30 days in the period 1541-1582
40·28 „ „ „ 1583-1642
31·09 „ „ „ 1643-1702

what possibly could be more conclusive?

Especially favoured is the wage-earner of Australasia who can command the same power by the expenditure of 4·34 days' labour; whereas it would cost the same class in 1583-1642 the fruits of 40·28 days, *i.e.*, nearly ten times more. Surely this alone should dispose of all reckless statements having a contrary tendency in measuring comparative advantages with the present time. The lowering of the death rate, and the consequent more rapid increase of population; the relative decrease in the proportion of paupers, especially the able-bodied; the decrease in serious crimes, all tell the same tale of unparalleled progress.

The Present Condition of the Masses in England and Wales as Compared with Their Condition During the 200 Years Ending in the Year 1800.

If still we must admit that the present condition of England and Wales is such that great misery oppresses many, it must also be borne in mind that her present death rate, 19·3 per 1,000, is the lowest upon the records; and her natural rate of increase, although far below that of the colonies, shows an increase of 1·4 per cent. per year.

No statistics directly bearing upon the misery and death rate of the 200 years ending 1700 are available, but there is good evidence to show that the population in the year 1500 numbered about 2,300,000. In the year 1700, or 200 years later, it only numbered 5,475,000, *i.e.*, an increase of 3,175,000 in 200 years, equivalent to an increase of *one per* 1,000 *per year*. There is every reason to believe that the birth rate was at least as high as in recent years; and if this be correct, it follows that the death rate must have averaged 34·3 per 1,000, instead of 19·3 per 1,000, as in recent years.

Now, what does this mean. Why, that formerly the struggle for means of existence was so terrible that 15 deaths per 1,000 persons took place beyond the number now occurring. This lamentable state of things is better realised when we see that it represents the destruction of the possibility of 2,364,800 lives in the 200 years referred to, above the average rate now occurring.

Surely this evidence should dispel all doubt respecting the comparative state of misery, past and present.

Nor is this all. Mr. Giffen (1) has shown by unmistakable reference to facts that in the admitted great increase of wealth during the last fifty years the rich have not improved their incomes in the same ratio as the working classes. Thus:—

PROGRESS OF NATIONAL INCOME IN MILLIONS OF £'S.

	INCOME.		INCREASE.	
—	In 1843.	Present Time.	Amount.	Per Cent.
Capitalist Classes from Capital	190	400	210	110
Working Income in Income Tax Return	90	180	90	100
Working Income Not Included in Income Tax Return ...	235	620	385	160
—	515	1200	685	130

Thus we perceive the falsification of Mr. Henry George's statement with regard to the alleged exemption of the working classes from any share in the present progress in the aggregation of wealth; for not only do they also share in the material progress of our times, but it is shown that the proportion of the lowest group in the increased wealth (160 per cent.) is by far greater than that of the two higher (100 to 110 per cent.) It is impossible to enumerate all the comparative advantages of those who live in the present day, due to improvements in knowledge, but the indices given should decide all earnest enquirers that whatever difficulties still exist are small, indeed, in comparison with what men suffered from in former times. The greatest difficulty which now threatens, is not that man's power to further command the forces of Nature may fail, but the far more serious consideration: Will the increase of such power be commensurate with the high rate of natural increase which is the inevitable concomitant of a comfortable existence? This brings us to the problem of problems—Population.

INCREASING NUMBERS.

Residents of new countries, with a scant population, and with vast natural resources in the shape of unlimited areas of unoccupied and unutilised virgin lands, longingly picture the transformation of these areas into yellow cornfields, fruitful gardens, verdant pasturage teeming with browsing cattle, busy industrial centres crowded with the homes of industrious and happy people.

Ah! little do they know of the never-failing Nemesis which, like a sleuth hound, dogs the steps of an ever-increasing population. Happy selectors of easily-acquired choice lands may luxuriously grumble at the amount of their taxation, the *low price of mutton and corn*, their bad roads, and the impossibility of extending their operations in the production of corn and wool, so long as the wages of farm and other labour are *so high*.

The professional and merchant class may reasonably grumble at the scarcity of men and products which restricts their respective callings, and may impatiently rail against the slow progress which the country is making in *population* and *the creation of products*. The few wealthy men of leisure may hanker after the amusements and honours so common in thickly-crowded centres, where the *attractive ministry of cheap labour* is but too common.

The comparative comfortable artizan or labourer, under such favourable conditions, may *in verbal or literary debate* still wage a lively dispute whether the irksome eight hours' labour—or weekly half-holiday—may not be further improved, and the rate of wages *further raised above the rates of over-peopled old countries*, but he does not view with favour the fresh introduction of labourers in *his own craft*.

The consumers of the services of local dear labour may desire the introduction of the surplus cheaper labour of Europe, and for the sake of Protection may urge upon the Government the necessity of extending the advantages of external Free Trade. On the other hand, the protector of a local monopoly of relatively high wages or more dearer local manufactures, may more strenuously advocate the necessity of increasing the tariff on all manufactures from other countries, especially on such as may be produced locally. It will be seen, therefore, that in young countries, as well as in the old, we have the battle of interests still waged, if not so keen. The competitor or seller of services cries for Protection; and the user or consumer of services enlarges upon the harmonies and advantages of universal Free Trade.

Few recognise the truth that individual welfare depends less upon the greatness of the aggregate wealth of a country than upon the proportion which freedom from excessive competition gives each individual over the local natural sources of utility, including primary wants; and that the country possessing the greatest aggregate of material wealth may, owing to the competition of excessive numbers, present the spectacle of a small privileged minority absorbing an unparalleled share of luxurious wealth, while the masses are struggling for the barest subsistence.

All other things being equal, it follows that in the country where Nature's gratuitous stores of wealth, as regards food and other essential products, far exceeds the power of its inhabitants to utilise, yet, notwithstanding the comparative insignificance of its accumulated wealth in exchange, its inhabitants on the average are individually happier, and enjoy a much larger share of material comforts, than the inhabitants of countries, however great the aggregate wealth, but whose natural resources as regards food products are far below the local requirement of its teeming inhabitants.

Two nations standing in this relation to each other would correspond to the relation of two individuals where one is the privileged capitalist or buyer, and the other the unprivileged seller of labour service. In other words, the latter would be in the position of the needy Esau in being forced to sell his whole birthright to preserve his life; the former would occupy the favourable position of Jacob, who had merely to part with a portion of his surplus of primary wants (red pottage) to secure a large augmentation to his wealth of pleonexia.

This, unfortunately for many old centres of civilisation, is no overdrawn statement—the creation of enthusiastic declamation or sentimentality—for if we take one of the most vigorous countries of Europe (England), with its untold wealth in the aggregate, and compare it with the young colony of Victoria, we may readily demonstrate the verity of what has been alleged.

POPULATION DIFFICULTIES, OR THE STRUGGLE FOR EXISTENCE.

Darwin (page 52, Origin of Species) has observed "that in a state of nature almost every full-grown plant annually produces seed, and amongst animals there are few which do not annually pair. Hence we may confidently assert that all plants and animals are tending to increase at a geometrical ratio—that all would rapidly stock every station in which they could anyhow exist. And this geometrical tendency to increase must be checked by destruction at some period of life," and, as an inevitable consequence, he goes on to add "that each individual lives by a struggle at some period of its life, that heavy destruction falls either on the young or old during each generation, or at recurrent intervals. Lighten any check, mitigate the destruction ever so little, and the number of the species will almost instantaneously increase to any amount."

These considerations, when fully appreciated, form the foundation of the problem of Malthus.*

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* An Essay on the Principle of Population. Malthus. (2 vols, London, 1826.)

That Mr. Henry George altogether failed to grasp the various elements of this problem is at once apparent by the manner in which in his otherwise very attractive work, "Progress and Poverty," he has attempted to refute the conclusions of Malthus.

As he has fallen into the most simple errors in his adverse comments upon Malthus, it may be as well to state with greater precision the factors of the problem, thus:—

P.—Actual population.

I.—Natural tendency to increase.
  (*a*) At its maximum in an ideal state of perfect health, virtue, peace and prosperity.
  (*b*) At its minimum when the opposite of this state obtains.

T.—Natural limit of life; death at extreme old age.

C.—Checks, cutting off life before the healthy limit of life has been reached, among which are prominent:—
  (*a*) Competition of other forms of animal life—zymotic diseases, parasites, attacks by beasts of prey, etc.
  (*b*) Insufficiency of food or famine, whether from seasonable influence, poor soil, climate, ignorance, wilful waste, or improvidence.
  (*c*) Violence, wars, murders, accidents, physical causes, such as earthquakes or volcanic outbursts, cannibalism, infant and senile murder, massacre.
  (*d*) Diseases, whether due to ignorance, vice, human neglect of hygiene, climate, cosmical influences, etc.
  (*e*) Diseases due to the tendency of civilised communities to aggregate in dense numbers, as in cities and towns.
  (*f*) Misery the close attendant of these evils.

M.—Moral restraint operating upon I.

E.—Means of subsistence, varying with season, but increased absolutely by numbers and increasing knowledge of natural resources; the ratio per individual, however, gradually lessening as the poorer lands and waters are invaded by swelling numbers.

F.—The absolute limit when a greater density for each square mile of the earth's surface is reached by removal or the minimising of all repressive checks. About 2·83 acres in cultivation is now necessary for the support of each person living.

G.—The final stage, the world peopled to its full limit, and the struggle for existence only permitting a perpetuation of the maximum population at F by the effects of T; and the failure of either in any degree, again re-introducing of necessity checks C, *a*, *b*, *c*, *d*, *e*, and so producing a decline in population, although the natural tendency I to multiply may still be conceived to be as vigorous and prolific as at the first.

When Malthus affirmed that the ratio of increase of population advanced faster than the ratio of increase of means of subsistence, he never stated or conceived that population could actually outstrip the means of subsistence as interpreted and discussed by Mr. Henry George (p. 17, book ii.), and hence the whole of Mr. George's citations and reasonings are either fallacious, or they never touch upon the real causes at the root of Malthus' problem. That there is a thorough misconception on the part of Mr. Henry George is clearly proved by the following quotation from Malthus (p. 243, vol. ii. "Malthus on Population"):—"According to the principles of population the human race has a tendency to increase faster than food. It has, therefore, a constant tendency to people a country fully up to the limits of subsistence (F or G), but by the laws of Nature it can never go beyond them, meaning, of course, by these limits the lowest quantity of food which will maintain a stationary population. Population, therefore, can never, strictly speaking, precede food." This clear expression on the part of Malthus casts aside the whole of Mr. George's ratiocinations as worthless. His inability to grasp the most important elements of the problem is still further made manifest by his query, p. 17, "How is it, then, that this globe of ours, after all the thousands, and it is thought millions, of years, that man has been upon the earth, is yet so thinly populated.

I can hardly conceive that a man of Mr. George's intelligence could put forward such a plea in proof of his contention that the natural tendency of population (I) is not towards an increase in the direction of the limits of subsistence.

His query indicates unmistakably that he confounds the product with the ever-varying factors plus and minus I, T, and C, which make the product (P). There is no argument necessary to show the absurdity of ignoring the value and tendency of I, because the product P does not disclose a similar value and tendency.

For example, the query entirely ignores the whole burden of Malthus' problem by the effects of the checks T and C. The mere fact, notwithstanding the powerful influence checks

T and C, which have always been in operation—the human race is now, after a million years, still vigorous, and numbers over 1,480 million souls, is in itself the strongest proof that the natural tendency to increase has been the powerful influence counteracting the terrible effects of C, which we too well know have always exerted a most powerful and dire influence in preventing a large increase of population.

The fallacy of Mr. George's arguments is more clearly appreciated by stating the problem thus:—

Let I.—Natural tendency to increase (birth rate).

D.—Actual rate of increase or decrease of population (*a*) surplus of births over deaths; (*b*) stationary state, etc.; (*c*) surplus of deaths over births.

T.—Death as the full termination of a natural healthy life }
C.—Death from preventible causes } Death Rate.

M.—Moral influence lowering the value of I.

S.—Prosperity heightening the effect of I.

P.—The result upon the population (*a*) increase; (*b*) stationariness; (*c*) decline.

D.—The actual surplus (*a*); stationariness (*b*); decline (*c*) per year.

1. When I + S — M exceeds T + C, the result will be P *a* or D *a*, or an increase of population.
2. When I + S — M only equals T + C, the result will be P *b* or D *b*, or a stationary state of population.
3. When I + S — M falls below T + C, the result will be P *c* or D *c*, or a decline in population, caused by the checks being greater than the birth rate.

What folly, therefore, to conceive a stationary state of population as being due to the lowered absolute influence of I alone, when the same result, according to our experience, based upon the vital statistics of all countries, is due rather to the increased value of C, the root evil, which Malthus wished to see eliminated.

That a high death rate has a greater influence than a low birth rate in diminishing the surplus of births over deaths is easily proved by reference to vital statistics—our only guide in such matters. For example, take the case of Norway and Spain and Hungary for the year 1885:—

	I + S — M Birth rate per 100 persons.	C + T Death rate per 100 persons.	D *a* Surplus of births over deaths per 1000 persons.
Norway ...	30·9	17·1	13·8
Spain ...	36·6	30·6	6·0
Hungary ...	45·3	32·6	12·7

No better example from actual facts could be obtained to show that the increase of disease and misery, as shown by the death rate C + T has more influence in lowering the value of B a, or surplus of births over deaths, than the lowering of the rate of births; for Norway's actual rate of increase is higher than that of Spain and Hungary respectively by 7·8 and 1·1 per 1,000 persons; although its birth rate is actually lower than in these countries by 5·7 and 14·4 per 1,000 respectively. In a healthy, happy, prosperous, and peaceful country, the actual rate of increase is invariably high, due to a high birth rate and a low death rate.

In an unhealthy, miserable, and savage society, the tendency, while these conditions last, is invariably shown in a higher death than birth rate, resulting in a positive decline in population.

It is clear, therefore, that when population is declining it is rather because misery, disease, and vice have abnormally raised the death rate higher than the birth rate, and not because of any material tendency to a decline in the birth rate.

While there are different stages of civilisation in existence, over-population is a relative term applicable to the particular country, and not an absolute quantity to be determined by an absolute number of persons to a given area, as most erroneously indicated by Mr. George. This is clear to any one who studies the civilisation and the sanitary state of different countries.

When peoples who have attained to the same state of civilisation are so situated that the struggle for existence is made ligther for a given community by local causes, such as may be seen in the comparison between the Australian colonies and the older countries of Europe—then the increased prosperity, the diminution of competition for labour, the increased health due to the smaller density of population, and other advantages—climate not being too unequal—would show such an improvement in the actual rate of increase from natural causes alone that their effect is significant and instructive. Thus, although the actual rate of increase in the colonies, during many years, is equal to about 20·05 per 1,000 (not including the effects of immigration), or about 10 per 1,000 above the rate of Europe, nevertheless, its average birth rate is only about 1·5 per 1,000 higher. This again forcibly proves that the higher rate of actual increase to population is due mainly to favourable circumstances lowering check C, or deaths from preventible causes. These illustrations by explicit reference to actual facts entirely overthrow the arguments of Mr. Henry George, which solely confine attention to one of the two great factors in the problem relating to the causes of the increase, stationariness, or decline in the population of different countries. Malthus was not so visionary as to expect the entire elimination of any of the factors. He only hoped to regulate population in relation to means of subsistence, by the substitution of an increased power of check M, in place of the terrible check C. He conceived that as man grew in knowledge and dignity, he might be able by degrees to lower the terrible influence of C, thus favouring the state P *a*; the latter being prevented from again re-introducing the evil effects of C by the substitution of influences increasing the power of the superior central check M. If the check C now ruthlessly in operation be removed altogether or reduced to a minimum—a most desirable thing for its own sake, it is certain that the geometrical increase of I would produce a maximum effect as D *a*, and this would sooner or later, if unchecked, over-populate the whole earth. No matter in what degree the final stage was delayed by increased knowledge and productiveness, fairer modes of wealth distribution, and the gradual spread over all habitable areas; or hastened by exhaustion of existing sources of wealth, or a state of anarchy; the stage would in effect be often reached in particular isolated districts, although not in all, by reason of human ignorances, jealousies, prejudices, not to mention lower types of human beings unfitted for the reception of a higher civilisation.

Had it not been for the fortunate discovery of the steam engine, the perfecting of means of transport, and the discovery of new fertile continents (Australia and America) thinly populated, opening out vast additional sources of production and affording relief to the pressure of crowded European centres, it is certain the state of Europe would be very different at the present hour; and the check C would long ere this have reduced existing crowded centres to half their present numbers. What would England do with her present population (37 millions) if America and Australia were no longer open to her emigrants and no longer furnished food and other products? England is now a striking example of a country whose population has rapidly outstripped the means of subsistence so far as local supply of food is concerned.

It will readily be conceived, therefore, that the complicated problem of Malthus is—the elimination of C altogether, or, as far as it lies within man's control; with the substitution of an increased power of M, only when deemed to be absolutely necessary to banish the dire influence of C. Both Malthus and Mr. Henry George agree in desiring the elimination of check C, but Malthus showed that this constant effect, due to vice, ignorance, disease, and misery, could only be finally grappled with effectually, by never allowing P, or density of population, to press too strongly on the means necessary to preserve a population in a healthy and happy state, and this could not be practically effected without some such controlling influences as M. The nobleness of Malthus' aims, and the problems which he endeavoured to grapple with, are altogether misconceived by Mr. George and other opponents. Some (might I not add the popular view) even maliciously or carelessly identify the Malthusian problem with the revolting physical check of Condorcet and others; and also of the view which rests in considering vice and misery as necessary evils. This proves that such people have not honestly studied the views of this much-wronged philanthropist. This is indisputably proved by the following quotations from his writings, pp. 478, 479: "Vice and misery, and these alone, are the evils which it has been my great object to contend against. I have expressly proposed moral restraint (M) as their rational and proper remedy; and whether the remedy be good or bad, adequate or inadequate, the proposal itself and the stress which I have laid upon it, is an incontrovertible proof that I never can have considered vice and misery as themselves remedies." In connection with these unfair charges urged by a Mr. Graham, he, in a dignified rejoinder, maintains, "It is therefore quite inconceivable that any writer with the slightest pretension to respectability should venture to bring forward such imputations, and it must be allowed to show either such a degree of ignorance, or such a total want of candour, as utterly to disqualify him for the discussion of such subjects." And with respect to charges identifying his view with the restraints prescribed by Condorcet, he distinctly affirms, "I have never adverted to the check suggested by Condorcet without the most marked disapprobation. Indeed, I should always particularly reprobate any artificial and unnatural modes of checking population on account of their immorality and their tendency to remove a necessary stimulus to industry . . . the restraints which I have recommended are quite of a different character. They are not only pointed out by reason and sanctioned by religion, but tend in the most marked manner to stimulate industry. It is not easy to conceive a more powerful encouragement to exertion and good conduct than the looking forward to marriage as a state peculiarly desirable, but only to be enjoyed in comfort by the acquisition of habits of industry, economy, and prudence, and it is in this light I have always wished to place it." How clearly and nobly Malthus explains his check of moral restraint is a matter which ought to leave no doubt of the purity and nobleness of his views, whatever doubts may remain as regards the efficacy of the moral check in itself. The possibility of the check, too, pre-supposes the general possession of moral strength sufficiently inadequate, not merely during large intervals of time, but at all times; for the effects of opposing passion might wreck its efficacy at any moment if we do not contemplate the superior strength and continuous exertion of the higher moral virtue.

I think I have in these observations fairly vindicated the nobility of Malthus' ideal, however we may demur to it as regards adequacy. It has also been clearly shown that the problem is a serious one; and individuals, and the poorer classes often reach the limit of the means of subsistence long before society as a whole feels its pressure. How are we to eliminate the elements of disease, vice, and misery which at present form the only check C against over-population in crowded centres without substituting some adequate check of a superior kind? This is the problem of Malthus.

Let us see what a small percentage of increase in population would effect in a short period of time.

If murder, war or epidemic, disease or misery, be not further increased, it would follow inevitably—

That the offspring of eight persons alone, at the present rate of natural increase in Australasia, would so multiply that:—

(8 persons) In 961 years they would number 1,480 millions, equal to the whole present population of the globe.

1314·3 years they would place one person on *every* 100 *square yards* of the land surface of the globe.

1527 years they would place one person on *each square* yard of the estimated cultivable portion of the earth's surface.

1543·9 years they would place one person on *each square* yard of the total surface of the land of the globe.

But it is more terrible still if we contemplate starting with the existing population of the earth, *viz.*, 1,480 million persons, and if we also reckon that the same number of acres must be cultivated to supply each person, as at present, *viz.*, 2·88 acres per head nearly.

With these conditions—

(1,480 millions) In 85·03 years there would be one person to every 2·83 acres of all the cultivable land surface of the globe.

122·48 years there would be one person to every 2·83 acres of land surface, whether cultivable or not.

157·6 years, or in the year 2047, there would be one person to *every acre* of land open to the foot of man, supposing that one acre was by some miraculous means sufficient for his support, and that all arctic and torrid parts of the earth could be made habitable.

586·15 years, or in the year 2476, there would be one person to every square yard of total land surface on the globe, supposing that by miraculous intervention life could exist under such conditions.

United Kingdom.

The natural increase of the population of the United Kingdom in recent years, owing to comparatively low death rate, has been increasing at the rate of 1·4 per cent. per year. The density of population of London is at present about one person to every 90 square yards.

In 339·9 years—if misery and disease does not increase the death rate—her population would cover the whole land as a vast city with a density equal to the present City of London.

157·7 years this density would be reached under the same conditions, if the death rate was as low as in Australia at the present time.

United States.

The present limits of the United States are stated to be about 2,291,355,000 acres, and her present population may be stated at about 57,000,000. Allow that the present average of 2·81 acres per head in cultivation is necessary to supply the wants of each person, and that ⅘ths of her whole area are available for cultivation. Then if her death rate be not raised by misery and disease, the population would increase at the rate of 2 per cent., as at present in Australia (*i.e.*, if no *providential* influence checks the birth rate), and

In 119·8 years, or in the year 2009, the limits of available land would be reached, *viz.*,

134·4, or in the year 2023, under the same conditions, this limit would be reached, even if it were possible to cultivate every square yard of the whole country.

Nothing shows better the incoherence of Mr. Henry George's so-called disproof of the Malthusian theory as in that portion where he deals with man as limited by space. The figures referred to show, without doubt, that if misery as a check to population be banished, the increase to population would at least be not less than 2 per cent. per year, and this would in 85 years, or within the limits of the life of persons now living, exhaust all available lands, even if all available lands (providing 2·81 acres for each person) could be made to yield the same average as the better lands now cultivated; and this near contingency Mr. Henry George scoffs at as something so distantly remote "as to have for us no more practical interest than the recurrence of the glacial period or the final extinguishment of the sun." Rhapsodical nonsense of this sort ill-becomes one who professes to discuss so momentous a question, and one who professes to be so enthusiastic in attempting to grapple with the real difficulties which hitherto have barred the material, intellectual, moral, and social progress of mankind.

On the other hand, it is logically impossible by any scheme of civilisation yet propounded by man, except that suggested by Malthus (moral check), to dispose of the existing misery of mankind.

It would be inhuman to perceive this terrible dilemma, and not in heart and spirit rebel against it. Who does not flinch as he gazes upon this terrible enigma? It is no wonder, therefore, that many emotional natures are either struck mentally blind at the fierce light, or try to escape the bitter conclusions which calm reason points out as inevitable by concealing, ostrich like, the eyes of reason in the sands of passionate rhetoric. The worst calamities that exist seem to be far more easily borne if we could but suppose them to be solely the results of man's own doings. In this conclusion there is a hope of escape in the thought that *man may undo or amend what he has done amiss.* Hence, no doubt, the natural repulsion of Mr. Henry George to the terrible thought that the inexorable laws of Nature dominate, corporeally at least, over the single life, and over the types of Adam's race, much in the same way as Nature has hitherto dealt with the thousand types of earlier races that have vanished. He but utters the human cry of passion when he urges that this is not the doing of the Almighty Ruler. "We degrade the Everlasting; we slander the Just One. A merciful man would have better ordered the world." Alas! alas! Who does not, or has not at times, made similar despairing exclamations and passionate protests.

With respect to the statements of Mr. Henry George, which led to this outburst of declamation, they are but a repetition of the attitude of the gifted and eloquent M. de Lamennais that drew from Bastiat the following just rebuke, which applies equally to writers of Mr. Henry George's class:—[1] "In all this we see only fallacious declamation which serves as the basis of dangerous conclusions; and we cannot help regretting that an eloquence so admirable should be devoted to giving popular currency to the most fatal errors."

The possible annihilation of our race, like those races that have gone, has weighed upon the thoughtful and pitiful in all ages, but nowhere does this feeling find nobler expression than in the words of the most thoughtful and tender of living poets:—

> "Are God and Nature then at strife,
> That Nature lends such evil dreams:
> So careful of the type she seems,
> So careless of the single life?
> 'So careful of the type!' but no,
> From scarped cliff and quarried stone
> She cries, 'A thousand types are gone;
> I care for nothing; all shall go;
> Thou makest thine appeal to me;
> I bring to life, I bring to death,
> The spirit does but mean the breath;
> I know no more.' And he—shall he,
> Man, her last work, who seem'd so fair
> Such splendid purpose in his eyes,
> Who roll'd the psalm to wintry skies,
> And built his fanes of fruitless prayer,—
> Who trusted God was love indeed,
> And love Creation's final law.
> Though Nature, red in tooth and claw,
> With ravine shrieked against his creed—
> Who loved, who suffered countless ills,
> Who battled for the true, the just,
> Be blown about the desert dust,
> Or seal'd within the iron hills?
> No more! A discord. A monster then a dream,
> Dragons of the prime
> That lure each other in their slime
> Were mellow music, match'd with him.
> O life, as futile then as frail—
> O for thy voice to soothe and bless
> What hope of answer or redress,
> Behind the veil, behind the veil!"

Thus the poet's refuge is in the after life. But have we no hope of amelioration in the present. Yes, we do hope. But all our hopes may prove fruitless if we do not bravely face the real difficulty.

The substitution of the providential preventive check (the moral check of Malthus) to over-population, for the hitherto prevailing misery or repressive check is the one escape for society, even if it be only to maintain the social advantages that we now enjoy. Of countries which have as yet shown any tendency to successfully grapple with this problem, the only examples known to us are those of Switzerland and France, notably the latter.

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[1] Bastiat. "Harmonies of Political Economy." (Part ii., p. 90).

The average birth and death rates of 14 States of Europe, and seven colonies of Australasia, afford some idea of their relative influence upon population, thus:—

	Per 1,000. Birth Rate.	Death Rate.	Percentage Increase.
Average of 13 European States	33·8	23·5	1·03
Seven Colonies of Australasia	34·4	13·6	2·08
France	24·8	22·2	0·26

The low birth rate of France (not her death rate, which is even below the average of Europe) is the special reason why her population remains almost stationary.

That her birth rate should be 9 per 1,000 below the average of Europe is a remarkable thing. Is it due to a lowered racial vitality, or to moral and providential causes? If it be due to the latter influence, a study of the conditions of social life in France is of peculiar importance. The Hon. G. Shaw Lefevre, M.P., in his work on "English and Irish Land Question," has carefully studied the influence of large and small ownerships of the land, and unhesitatingly concludes that to the large proportion of small owners in France, as compared with England, is to be attributed the great superiority of the great mass of its industrial population. He states:—"The prophecies of Arthur Young and McCulloch that her system of small cultivation would lead to her becoming the pauper warren of Europe, and her sons the hewers of wood and drawers of water for the rest of Europe, have not been fulfilled. On the contrary, 'Production has been greatly stimulated by the sense and security of ownership; *but the population has not increased relatively in the same proportion; the average condition of the people, therefore, is vastly improved.* Pauperism is almost unknown in rural districts; the habits of industry and thrift are universal.'" The same author wisely observes:—"If the institutions of France have resulted in a self-acting process of adapting the growth of her population to the means of subsistence, it would seem to be not the least merit of a system which is based upon the wide distribution of property, bringing home to the *lowest, as well as the highest, the motives of restraint.*" If only a portion of this be true, the world will owe to France the grandest lesson in social economy. Here we see a possible escape from the terrible Malthusian dilemma. France has attained her present state of social welfare in rural districts by legal restriction against family entails, which lead to the agglomeration of big estates in few hands, and by legal facilities for land transfer; and Mr. Lefevre urges that England should follow her example. This matter should receive the greatest attention at the hands of legislators in these colonies, for mighty issues are at stake, socially and politically.

CAN A HIGHER CULTURE BE MAINTAINED IN ANY ONE COUNTRY WITHOUT REGULATING ITS INTERCOURSE WITH OTHER RACES OF MEN IN A LOWER PLANE OF CIVILISATION?

There is still another difficulty to face, even if one enlightened country by providence had succeeded in adapting the growth of that population to the means of subsistence.

And this difficulty now presses hard upon the labourers of a higher civilisation open by Free Trade to the competition of the labour market of a lower or more degraded form of civilisation. The partial exclusion of cheap Chinese labour from America and these colonies may, or may not, have been in accord with the principle of Free Trade; but it opens up a grave subject. For if a higher culture could be enabled by provident moral or self-control to successfully grapple and overcome the present enigmas of social science, how is it possible that such a culture could be effectually preserved if it were open to be disturbed by the cheap labour or the starvation price products of other nations, who, by improvidence and lack of moral control, were still sunk in the abyss of that wretchedness which is due to over-population? In this aspect I am humbly of opinion the doctrines of Free Trade and Protection require further consideration; and it is with the hope that the reasonable discussion of such matters may shed fresh light upon this and related problems that I have had the courage to address you upon these old, well-worn, but hitherto unsoluble difficulties belonging to social and economic science.

One thought impresses me not a little. It is this: All truths that are painful are blindly and passionately resisted by the majority, who also are ever prone to reward skill when it is employed in opposing or obscuring what is hateful. It cannot be hoped, therefore, that the warnings given with respect to the danger that awaits us in the near future will be much heeded at present. The world's greatest intellects and genius are, for the most part, supported in defending popular views; for it is not found to be a difficult matter for men of greatest literary talent and skill to show, where complications abound, that the true is false, and the false is true. Popular favour is a terrible taskmaster, for she refuses bread to those who fail to work her pleasure. I do not, therefore, undervalue the temptation which ensnares the majority of able minds to continue the defence of pleasant delusions, when these alone find a ready market of *exchange value*. But the evil time draws too near for delusive teaching. It is now necessary that those who see the rocks ahead should speak out faithfully.

THE EXPEDITION UNDER LIEUTENANT-GOVERNOR COLLINS IN 1803-4.

BY JAMES BACKHOUSE WALKER.

Read 14th October, 1889.

1. The Origin of the Expedition and the Voyage to Port Phillip.

In former papers which I have had the honor to read before the Royal Society, I have endeavoured to trace the influence of French rivalry in hastening the English settlement of Australia. I have shown that to the pioneer work of French navigators we owe the first admirable surveys of the southern coasts of Tasmania, and that it was wholly due to the apprehensions that those surveys excited that Governor King sent Lieut. Bowen from Port Jackson to take possession of the Derwent.

I have also briefly touched on the explorations of our own English sailors in the neighbourhood of the Derwent and in Bass' Strait, and the influence of their reports in deciding the choice of localities for new colonies, while I have followed the misfortunes of the unlucky settlement at Risdon, and described its collapse after a short and troubled life of little more than half a year.

The real history of Tasmania as an English colony begins with the departure from England, in the spring of 1803, of the expedition of Lieutenant-Governor Collins,* the founder of Hobart; and it is with the origin and misadventures of that expedition on its way to the Derwent that I have to deal in the present paper.

The project of the English Government to found a colony on the shores of Bass' Strait, and the unsuccessful attempt of Governor Collins to plant that settlement

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*The first lieutenant of the *Calcutta* published a narrative of the voyage of the expedition to Port Phillip, and of its failure there. "Account of a Voyage to establish a Colony at Port Phillip, in Bass' Straits, in H.M.S. *Calcutta*, in 1802-3-4. By James Kingston Tuckey." London, 1805.

The principal official documents relating to the expedition down to the date of its departure from Port Phillip, have been printed by Mr. Francis Peter Labilliere, in his "Early History of the Colony of Victoria," 2 vols., London, 1878, and also by Mr. James Bonwick, in his "Port Phillip Settlement," London, 1883. The Rev. Robert Knopwood's Diary has been printed by Mr. John J. Shillinglaw in his "Early Historical Records of Port Phillip," Melbourne, 1878; 2nd edition, 8vo., 1879. The diary was copied from the original then in the possession of the late Mr. Vernon W. Hookey, of Hobart.

at Port Phillip in 1803, may at first sight appear to be beyond the scope of the history of Tasmania, and to belong exclusively to that of Victoria. But Collins' expedition has absolutely nothing to do with the history of our Victorian neighbours. The sandhills of Port Phillip merely served for a month or two as a resting place for the colonists on their way to the Derwent. The short stay of Collins' people on Victorian soil was only an incident in their passage from England to Van Diemen's Land, like their touching at Rio or the Cape; and the story of those months is an essential part of the history of the first settlers of Hobart.

The idea of the settlement emanated from Captain Philip Gidley King, the then Governor of New South Wales, and was, doubtless, suggested to him by the arrival at Port Jackson of the French ship the *Naturaliste* from Bass' Straits, and the suspicions thus excited in his mind with respect to French designs on His Majesty's territories in New Holland.

Labilliere, i., 125.

On the 21st May, 1802—shortly after the arrival of the *Naturaliste*, but before Commodore Baudin's own ship had reached Port Jackson—the Governor addressed a despatch to the Duke of Portland pressing upon him the importance of founding a colony at the newly discovered harbour of Port Phillip, of the soil, climate, and advantageous position of which he had just received a very favourable report from Captain Flinders, who had explored it in the preceding month. The reason most strongly urged by King was the necessity of being beforehand with the French, who, in his opinion, were bent on getting a footing somewhere in Bass' Straits.

When the Governor's despatch reached England there was for the moment peace with France, but French movements were viewed with the utmost suspicion, and a speedy renewal of the war was regarded as inevitable.

Home Office to Colonial Office, 17th Dec. 1802.

H.M.S. *Calcutta* was under orders to take to New South Wales a further detachment of 400 male convicts and some 50 free settlers, and preparations were being made to send her off immediately. King's recommendation therefore came at an opportune juncture, and was at once taken into consideration.

Amongst miscellaneous Colonial Office documents in the Record Office, Mr. Bonwick found a paper which records the result of these deliberations. It has neither subscription nor address, and is undated, though from other evidence its date can be fixed at somewhere in the latter half of the month of December, 1802.

This document is of so much interest as setting forth the views of the Government on Australian colonisation at this important period, that it is here given in full:—

"MEMORANDUM OF A PROPOSED SETTLEMENT IN BASS'S STRAIGHTS.

"The attention of the French Government has recently been directed to New Holland, and two French ships have, during the present year, been employed in surveying the western and southern coasts, and in exploring the passage through Basses Straights to New South Wales. By the accounts which have been recently received from Governor King at Port Jackson, there is reason to believe that the French navigators had not discovered either of the two most important objects within those Straights, namely, the capacious and secure harbour in the North, to which Governor King has given the name of Port Phillip, nor a large island called King's Island, situated nearly midway on the western side of the Straights, and which extends about 50 miles in every direction.

"Governor King represents each of these objects as deserving the attention of Government, but especially Port Phillip, where he urgently recommends that an Establishment should be immediately formed, at the same time observing that, if the resources of his Government could have furnished the means, he should have thought it his duty, without waiting for instructions, to have formed a settlement there.

"The reasons adduced by Governor King in support of this opinion are principally drawn from the advantages which the possession of such a port naturally suggests for the valuable fishery that may be carried on in the Straights, where the seal and the sea elephant abound, and from the policy of anticipating the French, to whom our discovery of this port and of King's Island must soon be known, and who may be stimulated to take early measures for establishing themselves in positions so favourable for interrupting in any future war the communication between the United Kingdom and New South Wales, through the channel of Basses Straight.

"In addition to these reasons, it may be stated that it would be of material consequence to the settlement at Port Jackson, which has now arrived to a population of near six thousand persons, if an interval of some years were to be given for moral improvement, which cannot be expected to take place in any material degree while there is an annual importation of convicts, who necessarily carry with them those vicious habits which were the cause of their having fallen under the sentence of the law.

"From a due consideration of all these circumstances, it is proposed to adopt the recommendation of Governor King, and to appoint a competent person to proceed in the *Calcutta*, direct for Port Phillip, for the purpose of commencing the establishment there, by means of a certain number of settlers and male convicts, now ready to be embarked in that ship, and, further, that the establishment shall be placed under the control of the principal Government at Port Jackson, upon a similar footing to that on Norfolk Island.

"The expense of this new settlement, beyond what would necessarily attend the conveyance and supplies for the convicts if sent to Port Jackson, may be calculated at a sum not exceeding £15,000 a year, subject to a small additional charge, if circumstances should render it advisable to send some of the convicts under a sufficient guard to secure the possession of King's Island.

"With a view to this service, and for the purpose of keeping open the communication between the two settlements and with Port Jackson, it is thought necessary that a small vessel should be stationed in the Straights, to be employed in such manner as the Lieut.-Governor, acting under the orders of Governor King, may point out.

"Experience having proved the great inconvenience arising from the establishment of the New South Wales Regiment at Port Jackson, it is conceived that considerable benefit would result from selecting a detachment of the Royal Marines for this service.

"With a view of exciting the convicts to good behaviour, it is proposed that such of them as shall merit the recommendation of the Governors abroad shall be informed that their wives and families will be permitted to go to them at the public expense as indentured servants; and, to render this act of humane policy as conducive to the benefit of the Colony as the circumstances of the case will permit, it will be necessary that these families shall on no account be sent upon ships on which convicts shall be embarked, and that they shall be informed their reunion with the objects of their regard would depend upon their own good behaviour, as well as upon that of their husbands."

Downing-street to Admiralty, Jan. 1803.

The recommendations of the memorandum were adopted by the Cabinet. Early in January, 1803, it was ordered that the destination of the *Calcutta* should be changed, and that the convicts, with a detachment of 100 Royal Marines as guard, should proceed direct to Port Phillip, under the command of Lieut.-Colonel

David Collins, who was appointed Lieut.-Governor of the new Settlement. An urgent appeal was made to the authorities by Mr. Secretary King, of the Home Office, to send a proportion of women—to allow the wives of the married convicts to accompany their husbands, and to add a number of female convicts. Secretary King pointed out the mischief that had ensued in the Port Jackson colony from the disproportion of the sexes, and remarked, "To begin with a colony of men, *populus virorum*, will do for nothing in nature but what Virgil applies it to—a Hive of Bees." It would have been well if this sensible advice had been acted upon; as it was, out of 307 convicts who sailed from England, only 17 were accompanied by their wives. The military guard, officers and men, consisted of 51, of whom some seven had their wives with them. Free settlers were not much encouraged in those days; for, though it was the policy of the Government to introduce a certain proportion, the number was rigidly limited. Mr. Bonwick says that up to the year 1803 the whole number of free settlers introduced into New Holland was only 320, to a total population of over 7000. Thirteen persons obtained Lord Hobart's permission to throw in their lot with the new colony as settlers; and, of these, not more than three or four had wives with them. The Civil Establishment consisted of a Chaplain, the Rev. Robert Knopwood; three Surgeons, Messrs. Wm. I'Anson, Matthew Bowden, and Wm. Hopley; a Commissary, Mr. Leonard Fosbrook; a Surveyor, Mr. George Prideaux Harris; a Mineralogist, Mr. Adolarius William Henry Humphreys; and two Superintendents of Convicts.

The Colonial Office could probably have chosen no more suitable man than Lieut.-Colonel David Collins as Governor of the new settlement. Collins was an Irishman, having been born in King's County in 1756. He had seen military service; and, as a young Lieutenant of Marines, had been present at the battle of Bunker's Hill. When Governor Phillip sailed with the "First Fleet" in 1788, to found Sydney, Captain Collins accompanied him, as Judge Advocate. He served in this important capacity, and also as Secretary to the Governor, for eight years, returning to England in 1796, with high recommendations from Governor Hunter to the Duke of Portland for his merit and services to the young colony. During his stay in England he wrote and published his well known and valuable "Account of the English Colony of New South

Wales," the first volume appearing in 1798, and the second, which carried on the history to August, 1801, being published in 1802. The book met with a very favourable reception, and was reviewed by Sydney Smith, in the *Edinburgh Review*. The reviewer says, "Mr. Collins's book is written with great plainness and candour: he appears to be a man always meaning well; of good plain common sense; and composed of those well-wearing materials which adapt a person for situations where genius and refinement would only prove a source of misery and error." Collins is said to have been a remarkably handsome man, with delightful manners. He seems to have had not a little tact in managing men, and to have possessed many of the qualities requisite in the founder of a colony. If he erred in his judgment of the capabilities of Victoria as a place for settlement, he certainly showed sagacity in his choice of a site for Hobart.

The preparations for the new settlement were quickly pushed on; and, in April, 1803, the expedition was ready for sea. The 307 male convicts, and their military guard, were to be conveyed by H.M.S. *Calcutta*, in which vessel the Lieut.-Governor himself, and a select few of his staff—viz., Lieut. Sladden, the First Lieutenant of Marines; Mr. Knopwood, the Chaplain; and Mr. I'Anson, the Principal Surgeon—were also to be accommodated. At the period of which we are speaking, which was during the short peace which followed upon the Treaty of Amiens, the ships of the Navy were frequently employed for the conveyance of convicts to New South Wales. In the early days of the colony the convicts were brought out under contract,—the contractors receiving as much as £17 7*s.* 6*d.* per head for all shipped. The contractors had no interest in treating the people well, or even in keeping them alive. The consequence was a most scandalous state of things. It was estimated that during the first eight years at least one-tenth of those transported died on the voyage. In the "Second Fleet," in 1790, the mortality was awful. In one ship more than a fourth part died on board, and a large number after arrival. The unhappy people were shut up below, in filthy and stifling quarters; seldom allowed on deck, for fear of mutiny; kept under no discipline; and often subjected to brutal ill-usage. Besides the dreadful mortality on the voyage, the survivors arrived so enfeebled that the hospitals were filled with sick, many of whom succumbed; while a considerable proportion of the remainder never recovered from the effects of the passage. Afterwards, by the

March, 1802, to May, 1803.

Bonwick's "First Twenty Years of Australia."

adoption of the system of paying a premium for each person landed, thereby giving the contractors a direct interest in caring for the health of the convicts, a great improvement in their treatment was secured. During the peace, however, the Government preferred using ships of the navy as transports, thus giving employment to officers and seamen whom it was undesirable to discharge, in view of a probable renewal of hostilities, and at the same time ensuring that the convicts would be kept in a better state of order and cleanliness. The vessels could also, on their return voyage, bring home cargoes of timber for naval purposes at a small expense. The ships best adapted for transports were those which had been originally built for the East India Company, and had been purchased into the King's service during the war. The *Calcutta* was a ship of this class. She was commanded by Captain Daniel Woodriff, who had been in New South Wales in 1792 and 1793, and had been so favourably impressed with the capabilities of the settlement that, when he received orders to take out a transport, he petitioned Lord Hobart for a grant of land for his sons, with the view of settling his whole family in the colony. He had as his first lieutenant Lieutenant Tuckey, a young Irishman of great energy and ability, who afterwards wrote an account of the expedition, which was published in 1805.*

Gentleman's Magazine, 1804.

The *Calcutta* was to take the convicts and military, but a tender was necessary to carry the stores for the whole establishment. For this purpose the Transport Office chartered the *Ocean*, a ship of 481 tons, belonging to Mr. Hurris, of Newcastle, and commanded by Captain John Mertho. The stores, exclusive of provisions, amounted to the value of £8047*; the freight and probable demurrage were put at £2568; total, £10,615. The remainder of the civil establishment, seven in number; two of the officers of the Royal Marines (Lieuts. J. M. Johnson and Edward Lord); and the 13 free settlers and their families, were passengers on board the *Ocean*.

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* "An Account of a Voyage to establish a Colony at Port Phillip in Bass' Strait, on the South Coast of New South Wales, in H.M.S. *Calcutta.*" By Lieut. J. K. Tuckey. London, 1805. Lieutenant James Kingston Tuckey was born in 1776, at Mallow, County Cork. He entered the navy at an early age, and served with distinction in the Eastern Archipelago and the Indian Seas, and afterwards in the Red Sea. Broken in health, he was in 1802 appointed first lieutenant of the *Calcutta*, and served during the voyage to Port Phillip, returning to England in 1804 and publishing his book. In 1805 the *Calcutta*, in convoying ships from St. Helena, was captured by the French, after a gallant defence, in which Tuckey particularly distinguished himself. He remained in a French prison for nine years. During his imprisonment in France he married a lady who was his fellow prisoner. On his release in 1814 he was made commander, and in 1816 he obtained the command of an expedition to explore the River Congo. The members of the expedition suffered terribly from fever, which was fatal to 21 out of a total number of 56. Tuckey was one of the victims, dying on 4 October, 1816.—"Narrative of an Expedition to explore the River Zaire (Congo) in South Africa in 1816." London, 1818.

Transport Office, Memo. 7th April, 1803.

On Sunday, 24th April, 1803, the *Calcutta* and the *Ocean* left Spithead in company, and three days later took their final departure from the Isle of Wight. For the events of the voyage Mr. Knopwood's diary is our principal source of information.† The diary is taken for the most part from the ship's log; and the chaplain, while he tells us a great deal about the ports at which they touched, and about the dinners and amusements which they enjoyed at those places, says nothing about the condition of the convicts, and but little of the incidents of the voyage. The ships touched at Teneriffe and at Rio de Janeiro, where they stayed three weeks. Off the Island of Tristan d'Acunha the *Ocean* was lost sight of in a storm, and the *Calcutta* put into Simon's Bay, Cape of Good Hope, where she remained a fortnight. The good chaplain was a man who dearly loved good company and genial society, and from the fond way in which he lingers over the delights of Rio and the Cape, at both of which he managed to have a very good time, we can judge how irksome he must have found the long sea life of five months. Though well on in middle age he was still susceptible, for at Rio he remarks of the Convent de Adjuda, which received as boarders young ladies who had lost their parents:—"This I frequently visited, where I conversed with a very beautiful young lady named Antonia Januaria. Her polite attention I shall not easily forget, having received great friendship from her, and should I ever return there again shall be happy to see her." And a few days later he writes:—"I visited De Adjuda for the last time. I saw Antonia this eve at 5, and we took leave of each other with regret. Vale!"

It is so seldom that the chaplain indulges in sentiment that I cannot forbear quoting his reflections on leaving the Cape. "On our departure from the Cape," he writes, "it was natural for us to indulge at this moment a melancholy reflection which obtruded itself on the minds of those who were settlers at Port Phillip. The land behind us was the abode of a civilised people—that before us was the residence of savages. When, if ever, we might again enjoy the commerce of the world was doubtful and uncertain. The refreshments and the pleasures of which we had so liberally partaken at the Cape and Simon's Bay were to be exchanged for coarse fare and hard labour at Port Phillip, and we may truly say, all communication with families and friends now cut off, we were leaving the world behind us to enter on a state unknown." After leaving the Cape the *Calcutta* encountered a severe storm, and reached Port Phillip on the 9th October, where she found the *Ocean* at anchor, having arrived two days before her.

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* In the list of stores are the following items:—Ironmongery, £2525; clothing, &c., £1930; naval stores, £723; carts and implements of husbandry, £500; medical and hospital stores, £1380; six pipes port wine, £282.

† Mr. Labilliere discovered the log book of the *Calcutta* at Deptford Dockyard, and gives extracts from it in his book.

From the Chaplain's diary it appears that the voyage was uneventful, and that good order was preserved throughout, for there are only two or three entries of punishments, for trifling offences. The health of the convicts must have been fairly looked after, only four deaths from illness being noted and one from drowning. This presents a pleasing contrast to the mortality and ill usage which had been too common in the transports to New South Wales.*

2. The Port Phillip Failure.

Collins' ships anchored within Port Phillip Heads about a mile and a half to the eastward of the entrance.

Collins to King, 5th Nov. 1803, Labilliere, i., 131.

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* Lieut. Governor Collins in his despatch to Governor King reporting his arrival, states that he had brought with him 299 male convicts and 16 married women. From this it would appear that 8 convicts and 1 convict's wife had died on the voyage. It is difficult, if not impossible, to reconcile the varying statements contained in different documents with regard to the number and names of the free settlers. In a despatch to King, dated 16th December, 1803, Collins says that he has eighteen free settlers with their families, yet his official returns of 26th February and of July, 1804, show only thirteen at the Derwent. We have a list of thirteen persons who had obtained permission from Lord Hobart to accompany Collins' settlement, but apparently this list does not contain the names of all who eventually sailed with him. Thus, it omits the names of Messrs. Pitt, Nicholls, Ingle, Dacres, and Blinkworth, who are known to have come out with Collins to the Derwent as free settlers. The *Calcutta's* log records receiving on the 17th October six passengers from the *Ocean* to proceed from Port Phillip to Port Jackson. Deducting these from the total so far as known, would leave the balance within one of the number given in Collins' return.

On the day of their arrival the Lieut.-Governor and Capt. Woodriff went on shore. They returned in the evening, having found no water, and reported that the soil was very bad. The next morning they set off again to look for a good spot for the settlement. They examined the eastern shore for some miles as far as Arthur's Mount, and although they found a small stream of fresh water, the soil was so poor and sandy, and the shoal water made approach to the shore so difficult that they returned to the ship much discouraged. The next two days were spent in exploring the west side of the Bay for a distance of many miles, but with no better result. The soil was rather better, but there was no fresh water. In the words of the Chaplain—"Along the shore we returned by no means satisfied with the country." From this time Collins made up his mind that Port Phillip was unsuited for settlement, and that his stay could be only temporary, until some more favourable locality was found elsewhere to which he could remove his people. For the present, however, the necessity of immediately unloading his ships was imperative. Capt. Woodriff had instructions to proceed at once to Port Jackson to take in a cargo of timber; the *Ocean* was bound for China, and could not be detained without considerable expense. He therefore gave up further search for a good locality, and on the fourth day after his arrival fixed on a spot about eight miles to the eastward of the Heads—near the present township of Sorrento—where very good water had been got by sinking half a dozen casks in the sand, and here on a small flat of some 5 acres in extent he resolved to pitch his tents and encamp his people and stores. The ships were moved opposite to the selected spot, the convicts and military put on shore, the ground cleared, and the landing of the stores begun. This was a task of some difficulty, as the men had to go up to their middle through the water to carry in the goods from the boats. The bulk of the stores was piled in the open air, and the more valuable and perishable were placed in three large tents, a guard of ten marines being posted to protect them. This done, Lieut. Tuckey, accompanied by Mr. Surveyor Harris and Mr. Wm. Collins, was sent in the *Calcutta's* launch to survey the upper part of the harbour. They proceeded to the north west, and after two attempts reached the head of the Western Arm of Corio Bay, near to where Geelong now stands. The report brought back was not encouraging. The soil was mostly sandy, and, except a few acres at the head of

Tuckey's Voyage.

the Port, there was no land within five miles of the water which would grow corn. Water was everywhere scarce. Snakes were common, and insects innumerable and tormenting, but game was not plentiful and fish scarce. At the head of the Bay, where a level plain stretching to the horizen appeared more promising, the blacks were numerous and hostile. A mob of 200 attacked Tuckey's party, and were so pertinacious and threatening that Tuckey had to fire upon them with fatal effect.

It seemed to the Lieut.-Governor that any attempt to plant his colony in this apparently more favourable situation, amidst swarms of hostile savages, with his little military force of 40 men—already hardly sufficient to restrain the convicts—must only end in disaster. He wrote to Lord Hobart, "Were I to settle in the upper part of the harbour, which is full of natives, I should require four times the strength I have now." Yet this was the only alternative he could see to his present position in a waste of waterless sand. So gloomy was the view he took of the situation, that he even found the Bay itself wholly unfit for commercial purposes on account of its difficulty of access, and that, owing to the dangerous entrance and strong tides, it required a combination of favourable circumstances to enable a vessel to enter without disaster. His sole idea was to remove as soon as possible from these forbidding shores. His instructions from the Colonial Office had contemplated such a possibility, and allowed him considerable latitude of choice as to the final destination of the colony. "Although Port Phillip has been pointed out as the place judged most convenient and proper for fixing the first settlement of your establishment in Bass' Straits, nevertheless you are not positively restricted from giving the preference to any other part of the said southern coast of New South Wales, or any of the islands in Bass' Straits, which, upon communication with the Governor of New South Wales, and with his concurrence and approbation, you may have well-grounded reasons to consider as more advantageously situated for that purpose." With the idea, therefore, fixed in his mind that at Port Phillip nothing but failure was possible, it became his most anxious thought to obtain Governor King's permission to remove his settlement. But here was a new source of embarrassment. By the beginning of November the *Ocean* had landed her stores. Captain Mertho was anxious to proceed on his voyage to China, and to charter the ship for Port Jackson would entail a heavy expense. The

Collins' to King, 5th Nov. 1803.

Instructions, 7th Feb. 1803.

Governor was anxious to detain the *Calcutta* as long as he could, both for protection and to be at hand to assist his removal if affairs took a more serious turn. In this dilemma he found a friend in need in one of the settlers, Mr. William Collins, formerly a master in the navy, who had come out in the *Ocean* on a seal-fishing speculation. This William Collins volunteered to go to Port Jackson in an open six-oared boat to carry despatches to Governor King and to bring back his reply. Six convicts volunteered as a crew,* the boat was victualled for a month, and on the 6th November Mr. Collins started on his plucky trip. The surf was so bad at the Rip that he could not get out of the entrance for four days. A week later the *Ocean* was ready for sea, and sailed out of Port Phillip on her way to China. She was, however, destined to play a further part in the history of Tasmanian colonisation. When within 60 miles of Port Jackson Captain Mertho came upon William Collins in his cutter. The boat had been nine days at sea, and had had a very rough time of it. The captain took the people on board and carried them to Sydney, arriving on the 24th November, and the despatches were delivered to Governor King. King acted promptly, the more so, as from Grimes' report he was prepared for Collins' unfavourable account of Port Phillip. The *Lady Nelson* was on the point of sailing for Norfolk Island; he immediately changed her destination and sent her to Port Phillip with what little fresh provisions and live stock he could spare, and with orders to return with despatches. He wrote to Captain Woodriff begging him, if it was consistent with his instructions from the Admiralty, to assist by removing the convicts to the Derwent or Port Dalrymple; and, finally, he arranged with Captain Mertho for a charter of the *Ocean* for four months, at 18*s*. per ton per month, to proceed to Port Phillip to remove the stores. The *Ocean* and *Lady Nelson* sailed within four days after receipt of the despatches.

Collins to Hobart, 28th Feb. 1804.

King to Collins, 26th Nov. 1803.

Mertho to King, 26th Nov. 1803.

Governor King, in his despatch, fully endorses Collins' opinion about Port Phillip. "It appears," he says, "as well by Mr. Grimes' and Mr. Robbins' surveys, as by your report, that Port Phillip is totally unfit in every point of view to remain at, without subjecting the Crown to the certain expensive prospect of the soil not being equal to raise anything for the support of the settlement, unless you shall have made any further observations to

King to Collins, 26th Nov. 1803.

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* For this service the six men received conditional pardons.

encourage your remaining there. Perhaps the upper part of the bay at the head of the rivers may not have escaped your notice, as this is the only part Mr. Grimes and those that were with him speak the least favourably of. From this circumstance, I shall presume, it will appear to you that removing from thence will be the most advisable for the interest of His Majesty's Service." He then refers to Bowen's settlement at Risdon, and the reports from thence, and sends to the Lieut.-Governor Bass' and Flinders' MS. journals containing a description of the Derwent. He next discusses the relative advantages of the Derwent and Port Dalrymple (*i.e.*, the Tamar). The Derwent has the recommendation of being already settled on a small scale, and as being an excellent harbour for the China ships to touch at, and also for sealers and whalers. However, if it were not for the difficulties of approach in the channel of Port Dalrymple, and the possibility of not finding good land there, he would decidedly prefer the northern locality, as more advantageously situated, and particularly as a place of resource for the sealing and fishing vessels in Bass' Straits, and to protect the fisheries at Cape Barren and King's Island from the Americans. However, he leaves to Collins full freedom of choice between the two places.

Collins to Hobart, 14th Nov. 1803.

In the meantime Governor Collins had got all his people encamped in tents, and had placed his sixteen settlers in a valley near his encampment, where they established themselves in temporary huts. For the first few weeks the general health was good, but after that time sickness began to appear, and he had some 30 under medical treatment. A matter which troubled Collins more was the desertion of the convicts. The people had been very orderly for the first three weeks, but soon a spirit of discontent arose, and, immediately after the boat left for Sydney, three men absconded,—with some vague idea of reaching Port Jackson, or getting on board a whaler off the coast,—and within a week twelve were missing from the camp. Parties were organised in pursuit, and, at a distance of 60 miles from the camp, five of the runaways were recaptured and brought back. Hitherto the Governor had not caused his commission to be read, reserving this ceremony till he should be finally settled. Now he wished to make a public example of the delinquents; and, to add solemnity to the punishment, he had the garrison drawn up under arms, the convicts, clean dressed, on the opposite side, while the chaplain read the commission, the marines fired three volleys, and all gave three cheers for His Honor. The Governor

Collins to Hobart, 28th Feb. 1804.

then addressed the people, pointing out the comforts they enjoyed and the ill use they made of them, and the folly of desertion, which could only end in suffering and death, either from the attacks of the savages, or from starvation and hardships in the fruitless attempt to travel 1000 miles through a wild and inhospitable country inhabited only by savages. The five deserters were then brought up for punishment, and, in the presence of all, received 100 lashes each, administered by the drummers. Notwithstanding this example, desertions still continued in spite of all the vigilance that could be exercised. Some of the runaways, after a bitter experience of the miseries of the bush, voluntarily returned, in a deplorable state of illness and exhaustion, having travelled over 100 miles and subsisted on gum and shellfish. One or two were shot, others were recaptured, but on Collins' departure at least seven were left in the woods. What became of them was never known, except in one instance. Thirty years after, when the first party from Launceston went over to settle Port Phillip, they found amongst a tribe of blacks a white man, unable to speak English, and hardly distinguishable from an aborigine. This was William Buckley, one of the runaways from Collins' settlement. Buckley received a free pardon and settled in Tasmania. His huge ungainly form and heavy face were familiar in the streets of Hobart in the memory of many now living.

Collins to King, 29th Feb. 1804.

Considering the character of the people, and the fact that they were broiling on the sandhills in a Victorian summer, with an insufficient supply of water, and unemployed on any useful work, it is not to be wondered that disorder broke out in the camp. From Collins' General Orders, and Mr. Knopwood's diary, we learn of drunkenness amongst the marines, of plundering of the stores by the convicts. After some particularly daring robberies on Christmas eve, it was found that the military guard was insufficient, and, by the Governor's desire, the officers of the civil establishment, including the chaplain, formed themselves into an association to patrol as a watch at night for the protection of property and the maintenance of order.

Knopwood, 4th Jan. 1804.

The Governor did his best to find employment for his men by setting them to build huts, and to construct a stone magazine for ammunition, but he made no further effort at exploration, nor did he attend to King's hint that better country might be found at the head of the port. If he had done so it is probable that the systematic settlement of Hobart might have been long deferred.

It is the more inexplicable that the country on which Melbourne now stands was not examined, as the *Calcutta* proceeded up the Harbour and anchored in Hobson's Bay off the present site of Williamstown, actually taking in 55 tons of water from the River Yarra. Yet although the ship was away for some ten days no attempt was made to explore the shores of that river.

Calcutta's log, 22nd Nov. to 1 Dec. 1803.

On the 13th December the *Ocean* returned from Port Jackson, and with her the *Francis* schooner bringing despatches from Governor King. The appearance of the *Ocean* was hailed with delight, and the satisfaction of Collins was shared by all when they learnt the news of Bowen's settlement at the Derwent, and that the *Ocean* had been chartered to remove the people thither, or wherever the Lieut.-Governor thought proper. Collins' pleasure was rather damped by Capt. Woodriff's informing him that as the *Ocean* had arrived to remove the Colony, the *Calcutta*, in accordance with the Admiralty instructions, must immediately proceed to Port Jackson, where a cargo of timber for the use of the navy was awaiting her, and that she could give no assistance in removing the settlement. This would render it necessary to divide the convicts, the military and civil establishments, and the stores into two detachments, as the *Ocean* could not take them all at once.

Collins immediately set to work to prepare for removal. He set the people to build a temporary jetty, 500 feet long, over the flats, and soon had all hands busily at work loading the *Ocean*. As to his ultimate destination he was still in much perplexity, and for some weeks it was doubtful whether the Tamar or the Derwent would be the site of the principal settlement in Van Diemen's Land. Indeed, in those days the ignorance of the different localities was so great—being limited to the information acquired by Flinders in his flying visits—that the data upon which to base a decision were wanting. By the *Calcutta*, which left him on the 18th December, he writes to King that he will not come to a decision on a point of so much importance until Port Dalrymple had been examined by Wm. Collins, who was leaving in the *Francis* for that purpose. He will, in deference to King, give the northern port the preference, though he himself inclined to the Derwent. King in reply tells him that a schooner which had just arrived from Port Dalrymple reported the entrance and channel very dangerous, and the natives troublesome, and advises him to give up the idea of going there, and to decide for the Derwent.

Collins to King, 28th Feb. 1804.

This advice only confirmed the conclusion to which Collins had at last brought himself. He gives as his reasons, in addition to King's recommendation, that the advantages of being in a place already settled had great weight with him, but that a stronger consideration was the mutinous spirit amongst his soldiers, which, he thought, would be checked by the presence of the detachment of the New South Wales Corps at Risdon ; and, moreover, that he considered the Derwent better for commercial purposes than any place in the straits, and that he hoped before long to see it a port of shelter for ships from Europe, America, and China, and a favourite resort of whaling ships.

The Lieut.-Governor was so anxious to get away from the place he detested that he kept his people at work loading the *Ocean* all the week round, Sundays included. He says, in his General Order of Sunday, 31st December, "It has never been the Lieut.-Governor's wish to make that day any other than a day of devotion and rest ; but circumstances compel him to employ it in labour. In this the whole are concerned, since the sooner we are enabled to leave this unpromising and unproductive country the sooner we shall be able to reap the advantages and enjoy the comforts of a more fertile spot; and as the winter season will soon not be far distant, there will not be too much time before us wherein to erect more comfortable dwellings for every one than the thin canvas coverings which we are now under, and which are every day growing worse."

Collins to King, 27th Jan. 1804.

When Wm. Collins, on 21st January, returned from Port Dalrymple in the *Lady Nelson*—which vessel had taken him from Kent's Group, the *Francis* having proved too leaky to venture across the straits—he found the *Ocean* loaded and ready to go to the Derwent. The fact that he brought a report on the whole very favourable to Port Dalrymple did not induce the Lieut.-Governor to alter his mind.

A few days sufficed to select the people he intended to leave behind him, some 150 in number, of whom Lieut. Sladden, with a small guard, was to have charge, and to embark the majority, some 200 souls, on board the *Ocean*, the settlers finding a place on board the *Lady Nelson*. On the 27th January Collins writes to King that he was now only waiting for an easterly wind to clear the Heads and leave this inhospitable land behind. They had to wait four days for the wind; and on the 30th January, 1804, the *Ocean* and *Lady Nelson* sailed out of Port Phillip in company, and headed for the Derwent.

In his narrative of Collins' expedition Lieut. Tuckey says of the country he had just left: "The kangaroo seems to reign undisturbed lord of the soil, a dominion which, by the evacuation of Port Phillip, he is likely to retain for ages."—Surely as unlucky an attempt at prophecy as was ever made!

Could some truer prophet have lifted the veil of the future for Collins, he would have shown the disappointed Lieut.-Governor a picture which would have more than surprised him. He would have shown him, within little more than thirty years, a small party of adventurous squatters leaving Van Diemen's Land to seek a new land of wealth on the shores of Port Phillip. Amongst them he would have noticed a man—whom he himself had brought out as a boy in the *Ocean*, and taken to the Derwent,* and who was now returning to the unpromising and unproductive country which the Lieut.-Governor had abandoned in despair, to find in it a land of fair plains and of springs of water—a land of promise—a veritable Australia Felix—soon to be wealthy in flocks and herds. Such a prophet would have shown him this country, which he and Governor King agreed in thinking wholly unsuited for settlement, within another fifteen short years invaded by tens of thousands of eager emigrants rushing to secure at least some small share of its wonderful wealth, until in another generation it had grown into a land of gardens and farms, rich in corn and wine, crowded with villages and cities; and on the unpromising shores of Port Phillip there stood a great city, the centre of a free and prosperous state numbering more than a million souls.

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* Mr. John Pascoe Fawkner.

THE FOUNDING OF HOBART BY LIEUT.-GOVERNOR COLLINS.

BY JAMES BACKHOUSE WALKER.

Read 14th October, 1889.

1. The Choice of Sullivan's Cove.

On the 30th January, 1804, the *Ocean* and *Lady Nelson*, with the first detachment of Lieut.-Governor Collins' establishment, sailed from the Heads of Port Phillip for the Derwent. The *Lady Nelson* was commanded by Lieut. Simmons, with Jorgen Jorgensen as first mate. She took the settlers and their families, and the stores. The *Ocean* had on board 178 prisoners, with some women and children, a guard of 25 marines, under Lieut. Edward Lord, and the civil establishment, consisting of the Lieut.-Governor, the Rev. Robert Knopwood, Surveyor-General Geo. Prideaux Harris, Mr. Adolarius W. H. Humphreys, the mineralogist, Dr. Bowden, and two Superintendents of Convicts. The ship was greatly overcrowded. She had been fitted up in England to carry some 30 people besides her crew. She had now over 200 souls on board, and we can well believe Mr. J. P. Fawkner when he says that they had a miserable time of it during their 15 days' passage, cooped up in a small vessel of 480 tons. Fawkner says they suffered terribly from the want of cooked food, as the cooking accommodation for 25 had to serve for the whole 200. They were 10 days reaching the Pillar, and were there caught in a heavy south-wester, which kept them *Ocean's* Log.
two days off the Raoul. It then came on to blow hard from the north west, which obliged Capt. Mertho to bear up for Frederick Henry Bay, where he came to an anchor off Pipe Clay Lagoon. Here Lieut. Lord and **Knopwood,**
Mr. Humphreys were landed, with four men, to walk up **11th Feb.**
to Risdon with despatches, while the vessel lay wind-bound for another three days, the officers amusing

themselves by going ashore, where they were very much pleased with the appearance of the country and the abundance of game and wild fowl. The boat's crew filled their boat with fine oysters in half an hour on the shores of the lagoon. They also fell in with a party of 17 natives, who were very friendly. On the 15th February a change of wind enabled them to make the entrance of the river, where they were met by the boat of the *Lady Nelson*, which had arrived before them, and they ran up before the sea breeze, anchoring at half-past six in Risdon Cove, off the settlement of which Lieut. Moore was in charge, Lieut. Bowen being absent at Port Jackson.

At 10 the next morning, the Lieut.-Governor, with Lieut. Lord and the Chaplain, landed under a salute of 11 guns from the *Ocean*—the first salute fired in the Derwent—to inspect the Risdon settlement. They were received with military honours by Lieut. Moore and the 16 privates of the New South Wales' Corps drawn up under arms. After inspecting the settlement, the Lieut.-Governor came to the conclusion that Risdon was not a suitable site for a town, and returned on board the *Ocean* very much disappointed. It was the report of the advantages of Risdon that had led him to decide in favour of the Derwent rather than the Tamar, and now he had brought his people to a spot that promised as little as the abandoned Port Phillip. However, the next morning was bright with sunshine, and as he looked out over the waters of the Derwent, with its picturesque scenery of hill and valley and thickly wooded plains, things looked less gloomy. To be prepared for the worst, he directed the tents to be pitched at Risdon. Then the boat was ordered out and put in charge of the trusted William Collins, and the Governor, taking with him his favourite companion, Mr. Knopwood, was pulled down the river to a cove on the opposite shore some five miles below Risdon, and which had probably attracted attention on the way up. Here Collins landed, and, after a short examination, made up his mind that it was the very place for his settlement. We can imagine his admiration of the fine cove, with deep water up to the shore, and his profound satisfaction, after four months on the dry sand-hills of Sorrento, at finding himself on a well-wooded and fertile plain, lying at the foot of the great Table Mountain, and watered by a copious stream of splendid fresh water. In his first despatch to Lord Hobart, he says that the situation was all he could wish. There

Knopwood, 17th Feb.

4th March, 1804.

was land of good quality immediately about him sufficient for extensive agricultural purposes. The timber and stone were in sufficient quantity and quality for all his needs, and the cove would make an admirable harbour. Knopwood describes the site, not very accurately, as an "extensive plain, with a continual run of water, which comes from the lofty mountain much resembling the Table Mountain at the Cape of Good Hope. The land is good, and the trees excellent. The plain is calculated in every degree for a settlement. At five we returned and dined with the Governor, much delighted with the excursion." Collins devoted another day to the examination of a plain further up the river—probably in the neighbourhood of Glenorchy—which, he thought, might serve for the location of his free settlers. The trees were large and good, but the ground was so cut up by torrents that he decided it to be unsuitable. In the meantime the officers had been sent to look at the first site, and they returned with their unanimous approval of it. The Governor forthwith ordered the tents to be struck and sent on board the *Lady Nelson*, and the two ships were moved out of the cove. On the Sunday morning, in a strong northerly breeze, they dropped down the river and anchored off the bay, to which the Lieut.-Governor gave the name of Sullivan's Cove, in honour of his friend Mr. John Sullivan, the Permanent Under-Secretary at the Colonial Office.

Ocean's Log.

Knopwood.

Monday morning (20th February) was squally and wet, but in the afternoon the weather cleared, and a body of prisoners with a military guard was landed to pitch the tents on the selected site. At four o'clock the Lieut.-Governor himself, with his officers, went on shore for a short time to superintend operations. That night the marines and convicts slept at the new camp—the first Europeans to sleep on the site of the future capital of Tasmania.

20th Feb. 1804.

In a despatch to Governor King, Collins gives a description of the Cove in its original state. "In the centre of the Cove," he writes, "is a small island, connected with the mainland at low water, admirably adapted for the landing and reception of stores and provisions. Round this island is a channel for a boat, at the head of which is a run of clear fresh water, proceeding from a distance inland, and having its source in a rock in the vicinity of Table Mountain. The ground on each side of the run is of gradual ascent, and upon that next the Cove I have formed my camp. The *Ocean* and *Lady Nelson* are lying within half a cable length of the shore in nine fathoms water." The inhabitants of Hobart will hardly recognise their harbour in Collins' description. The filling up has been so considerable as to obliterate the original natural features. The creek has been diverted from its course, and the island, which Collins named Hunter's Island, after his old patron, has been swallowed up in the Old Wharf. Originally the Cove was much more extensive than it is at present. The island, which now forms the extremity of the Old Wharf, was then in the middle of the bay. This island was connected with the mainland by a long sandspit, covered at high water, and the site of which is now occupied by the long range of stores forming the Old Wharf. The bottom of the Cove was marked by a yellow sandstone bluff, since cut away, and now forming the cliff overhanging the creek at the back of the hospital. A little below this was the original mouth of the creek, which issued out of a dense tangle of tea-tree scrub and fallen logs, surmounted by huge gum trees. It fell into the river just at the intersection of Campbell-street and Macquarie-street, at the lower angle of the New Market building. The land at the creek mouth was flat and marshy for some distance. On the side towards the town the beach curved round the site of the old Bonded Stores, thence, along a slope covered with gum trees, by the back of the Town Hall, by Risby's Saw-mill and the Parliament Houses, past St. David's churchyard, and thence along the line of stone stores on the New Wharf to the Ordnance Stores, and round the old Mulgrave Battery Point. On the side of the creek towards the Domain was a low swampy flat, extending over Wapping and Lower Collins and Macquarie Streets to the Park-street rivulet and the present bridge leading to the Domain. Thence the beach ran round the foot of a wooded slope by the present Gas Company's office, along the course of the railway embankment, to Macquarie Point.*

Ocean's Log.

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* I am indebted to my friend Mr. Mault for a beautifully executed plan (*see* Appendix) which shows very clearly the original features of the ground, and the position of the first camp, and also indicates the alterations which have since taken place. It is taken from a survey made by Surveyor-General Harris in 1804-5. The original plan was discovered many years ago in the Lands Office at Sydney, and was presented by the New South Wales Government to our Lands Department. The Deputy-Commissioner of Crown Lands, Mr. Albert Reid, kindly presented me with a tracing of it.

2. The Founding of Hobart.

On Tuesday, the 21st February, 1804, the *Ocean* and *Lady Nelson* were warped up to within half a cable length of Hunter's Island, the rest of the people were landed, and the discharge of the stores began. The Lieut.-Governor's tent was pitched on the slope overlooking the cove near the spot where the Town Hall now stands. The Chaplain's marquee was pitched next to the Governor's, and those of the other civil officers in close proximity on the same slope. The tents of the convicts were further inland, extending from about the present Telegraph Office at the corner of Macquarie and Elizabeth Streets, back to Collins Street to the edge of the scrub in the valley of the creek. The camp of the marines was placed higher up towards the Cathedral. On the Tuesday night, Knopwood says, "I slept at the camp for the first time, and so did the Lieut.-Governor." Jorgensen, who as mate of the *Lady Nelson*, had assisted at the settlement of Risdon in the preceding September, and was now in the same capacity assisting at the founding of Hobart, gives us a graphic sketch of the scene on that first day. As soon as the tents had been pitched under the shadow of the great gum-trees, spades, hoes, saws, and axes were put into the hands of the prisoners, and they began clearing away as fast as they could. The block just opposite the Tasmanian Museum, behind the old Bank of Van Diemen's Land building to the neighbouring mouth of the creek, was then an impervious grove of the densest tea tree scub, surmounted by some of the largest gum-trees that this island can produce. All along the rivulet, as far up as the old mill beyond Molle Street Bridge, was impassable from the denseness of the scrub, and the huge collections of fallen trees and dead timber which had been washed down the stream and were strewed and piled in confusion in its bed. In many places the stream was dammed back, and spread out into marshes covered with rushes and water.

Knopwood.

Jorgensen's autobiog. in *Ross' Almanac,* 1835.

Governor Collins had amongst his various stores a small printing press, which had already done service at the Port Phillip camp. This was set up under a convenient gum-tree, and on the day of landing the first printed work issued from the Tasmanian press. It was a General Order, fixing the weekly rations to be issued to each person—viz., 7 lbs. beef or 4 lbs. pork, 7 lbs. flour, and 6 oz. sugar. The second day's order, with a backward glance at the casks sunk at the foot of the Port Phillip sandhills, expressed the Governor's satisfaction at having been enabled to fix the settlement advantageously, and in a situation blessed with that great comfort of life, a permanent supply of pure running water, and cautioned the people against polluting the stream. On the third day the hours of labour were fixed. The Lieut.-Governor having thus given his people some elementary lessons, enforced by appropriate sanctions, on the mutual rights and duties of the individual and the State, proceeded to care for their spiritual requirements, and on the fourth day issued an order for a general muster of the prisoners, and notified that on Sunday, weather permitting, divine service would be performed, at which all were expected to attend.

Hunter's Island had been appropriated for the site of the store tents, for which purpose it was admirably adapted, not only on account of its handiness as a landing place, but also because its isolated position made it comparatively safe from plunderers. All available hands were now employed to discharge the stores. The ships were moored at a short distance from the shore, and the cargo taken off in boats. A wharf was begun at the landing-place on the island, and a way was formed along the sandspit by means of which the mainland could be more conveniently reached at low tide. These works were placed under the superintendence of Mr. William Collins, the hero of the boat expedition to Port Jackson, and who had already given the Governor many proofs of his capacity. Even the Chaplain, usually the only idle man in the settlement, found employment during the first week. His diary tells us that it cost him three days' work to prepare a sermon worthy to be the first preached in the new colony. On Sunday, then, under the gum-trees on the slope near the Governor's tent, overlooking the waters of the Derwent sparkling in the bright February sunshine, the military paraded, the prisoners were drawn up, the officers and settlers formed a group apart, and the Rev. Robert Knopwood conducted the first service in Tasmania. "The sermon, by request of the Lieut.-Governor, was upon the prosperity of the new settlement, and to pray to God for a blessing upon the increase of it." This first Sunday had, however, practical duties, and after service the *Ocean's* boats moved the settlers, with their families and baggage, to the spot which had been fixed upon for them on the shores of New Town Bay, then known as Stainsforth's Cove, not far from where the Risdon Road leaves the Main Road.

Knopwood.

Ocean's Log.

On the same day the first census was taken, and it appeared that the population consisted of 262 souls, of whom 15 were women and 21 children.[*]

Of the group who landed at Sullivan's Cove in February, 1804, with our first Governor, the best remembered, and, indeed, the only one of whom tradition has anything to say, is the Chaplain, the Rev. Robert Knopwood. The survivor of all Collins' officers, he lived to times well within living memory, and many an old settler still tells stories of his eccentricities. His spare wiry little figure, on the well-known cream-colored pony, is familiar to us from Mr. Gregson's painting, taken in his later days when the camp had grown into a town, and he had bachelor quarters at Cottage Green. Of his qualifications as the spiritual guide of the young colony not much can be said, and of this he must have been fully sensible if the tradition is correct which reports his favourite saying to have been, "Do as I say, not I as do." The choice of Mr. Knopwood as chaplain was an unfortunate one. There was a fine field in those early days for a man who would have devoted himself—as Bishop Willson and others did in later years—with wise enthusiasm to the elevation of the society in which his work lay. It is doubtful whether Mr. Knopwood, clergyman though he was, ever made any serious attempt to raise the moral or religious tone of the community. He had been a chaplain in the navy, and, like too many chaplains of those days, was content to acquiesce easily and without uncomfortable protestations in the ways which were current. As a colonist, or

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[*] Number victualled at Sullivan's Cove, Derwent River, 26th February, 1804:—

Qualities.	*Men.*	*Women.*	*Children.*		
			Over 10.	Over 5.	Under 5.
Military Establishment.	26	1	—	—	—
Civil................	6	—	—	—	—
Settlers	13	5	8	2	3
Convicts	178	9	2	—	6
Supernumeraries[*]	3	—	—	—	—
TOTAL	226	15	10	2	9

[*] Mr. Brown, Botanist.
Henry Hacking.
Salamander, a Port Jackson native.

in any other capacity than a clergyman, he would have been valuable; as a chaplain he was a failure. Yet he was a genial little fellow, fond of good company and of a good dinner, not averse to a glass of good wine or a pipe with a friend, a lover of animals, an ardent sportsman, of a kindly nature, always ready to give good-natured help to any one in need. In spite of his grave deficiencies, and the conviction that he would have been better in a secular calling, one cannot help having a kindly feeling for the man who was always popular in the settlement, and was long familiarly remembered amongst early settlers as "Old Bobby Knopwood." The diary of the chaplain is the only contemporary material, except grave official documents, which we have for the history of the founding of Hobart. It runs to the end of 1804. The entries are meagre, and too much limited to records of dinners and the interchange of hospitalities amongst the officers; yet it is naïve and candid, and supplies interesting detail. Official records are dry reading, but even they yield unexpected treasures to careful study; and, from the early despatches of Lieut.-Governor Collins to Governor King and Lord Hobart, and from Collins' General Orders, with occasional side-lights from the Chaplain's diary, we can form an idea of life in the quaint little camp which at the beginning of this century was pitched on the narrow rise between the waters of Sullivan's Cove and the thick belt of tea-tree scrub shading the course of the Hobart Creek.

The Governor had planted his settlers at a safe distance at New Town Bay, and his total strength at Sullivan's Cove consisted of 178 convicts and the guard of 25 marines under Lieut. Edward Lord. The selection of prisoners for the settlement had been very carelessly made. The frequent burden of Collins' complaint to the Colonial Office is that he was encumbered with so many old, worn out, or useless men, who ate the precious provisions, better bestowed on artificers and stout labourers. Out of the whole 307 men who sailed with him 137 were labourers, but the trades useful in a new colony were very insufficiently represented, and the weavers, silversmiths, engravers, and clerks supplied to him by the authorities with more than sufficient liberality were likely to have long to wait before finding scope for their talents. In fact, the usual official bungling was exemplified in the new colony. The stores supplied by contract were as bad as usual. The Governor makes an exception in favour of the provisions, which he says

Collins to Hobart, 4th March, 1804.

Bonwick.

Collins to Sullivan, 4th March, 1804.

were excellent, the salt beef and pork being better than any he had seen in New South Wales. But with respect to the other stores he has one long complaint to make. The tools were bad; the axes so soft that the commonest wood would turn their edges; of the gimlets scarce one in a dozen would stand boring twice. The materials for clothing were of poor quality, and the thread rotten. The shoes were made of inferior leather, and were all of one size. The surgical instruments were of an obsolete pattern, and many of them worn out. The iron was rolled and not wrought, while neither glue, borax, rosin, nor bar steel had been thought of, so that the carpenters and smiths were in difficulties. The ordnance that had been given him for defence was incomplete, the guns of different sizes and patterns, while the ammunition was all of one sort. The seed corn brought from England would not vegetate, and if it had not been for some good seed which he obtained at the Cape, and some more which Governor King sent him, he could not have raised a crop of wheat. Except the provisions, the printing press was the only item of which he could speak with satisfaction, but for this they had not given him a sufficient supply of type or of paper. Of course, when the contractors were communicated with they all protested that the goods were carefully selected, of a quality superior to the pattern, and quite equal to those which the convicts had had heretofore. Perhaps this last statement was correct.

In spite of these minor difficulties, the work of settlement and improvement was pushed on with an energy and system presenting a strong contrast to the inaction and disorder of the Port Phillip camp. When the landing jetty at Hunter's Island was completed, all the strength that could be spared from the work of clearing was bent to the building of a Government House. He had 178 men in all, but when the necessary deductions were made for overseers, servants, cooks, boats' crews, labourers clearing away scrub or employed in other necessary work, and for the sick—always a large item, owing to the prevalence of scurvy and other ailments induced by the exclusive use of salt provisions—it will be seen that no large number would be left for the actual work of building.* It is most probable that the Governor selected and brought with him in the first detachment all the skilled workmen, leaving the most useless at

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* *See* Appendix : Return of Employments.

Port Phillip with Lieut. Sladden; but still the number available was small.

Gen. Orders, 22nd Feb. 30th April.

No idle time was allowed in the settlement. The bell rang at five in the morning, and the convicts turned out, clad in blue kersey jackets and trousers, and proceeded at once under their overseers to their various employments. Work was continued, with intervals of an hour for breakfast and an hour and a half for dinner, until six o'clock in the evening, when the bell gave the signal for the close of the day's labour. On Tuesday an extra hour was allowed for the issue of rations; Saturday was a half holiday after 11 A.M.; and it was only under exceptional circumstances that any labour was required on Sunday.

Gen. Order, 27th Feb.

There was ample work for all hands. A large proportion of the people had to be employed clearing away and burning the scrub, grubbing stumps, trenching, digging and preparing garden ground. Building operations were necessarily slow. A quarry had to be opened on the sandstone Point near the mouth of the creek to supply stone for foundations. Oyster shells were gathered from the beaches and burnt for lime. Governor King had sent a quantity of bricks from Port Jackson, and these were utilised for chimneys. The fine gums on the banks of the creek furnished an abundant supply of good timber. Stringent regulations were enforced against the useless destruction of the timber, and no trees might be felled without the permission of the Superintendent of Carpenters, to which office the Governor had appointed Mr. Wm. Nicholls, who had come out in the *Ocean* as a free settler. With the inferior axes supplied by the Government contractors, and which had their edges turned by the hard gum wood, felling was a tedious operation; and when the trees were felled and sawn into lengths, the logs had to be dragged to the sawpits by hand labour, and the sawn timber carried thence by the same means, for as yet there were neither horses nor oxen in the colony. The sawyers, of whom it appears there were nine, were constantly employed at the sawpits cutting the logs into posts and planks—two men at each log with a ripping saw—in the slow and laborious method so familiar to those whose memory goes back to the days when steam saw-mills were not. The progress at the sawpits was so slow that the Governor, notwithstanding his preference for day work, found it necessary at a later period to put the sawyers on task work; and no sawyer was allowed to work for his own profit unless

Gen. Order, 27th July.

he and his mate had turned out at least 400 feet of sawn timber in the week on the public account. It speaks well for the industry of the community and the energy of the administration, that the sawyers, carpenters, and other mechanics made such good progress with their work that in less than three weeks from the day of landing Government House was completed, and the Chaplain records in his diary on the 9th March, "The Lieut.-Governor slept in his house for the first time." This first wooden Government House was not on the same site as the brick building of later years, but stood on the spot now marked by the main entrance of the Town Hall.

Gen. Order, 24th March.

So soon as the Lieut.-Governor had got his house built he turned his attention to agriculture. A gang of some thirty men was sent to prepare ground for wheat for the use of the settlement. The place chosen was near the locations where the settlers had been set down a month before, on the shore of a bay named Farm Bay. This appears to have been at Cornelian Bay, at what was long known as the Government Farm, but is now occupied by the Cornelian Bay Cemetery. The farm was placed under the charge of Mr. Thomas Clark, who had been brought out from England as Agricultural Superintendent.

Collins' next care was to get his people housed under better shelter than canvas tents afforded. They were encouraged to use their spare time in building huts. This was an employment for Saturday afternoons, for Sundays—after service, when that was held—and for the occasional holidays allowed for the purpose by the indulgence of the Governor. The huts were of most primitive construction, being for the most part what old settlers will remember under the name of wattle-and-dab—or wattle-and-daub—with a rush thatch. Let me give you an idea of what a wattle-and-dab hut was like, and how it was built. Four corner posts were stuck in the ground, and upon these wall-plates were rested or nailed; further uprights were then added, and long rods of wattle from the bush were interwoven with the uprights, openings being left for door and windows. Mortar was then made of clay and loam, into which was mixed and beaten up wiry grass chopped up as a substitute for hair. This mortar was dabbed and plastered against the wattles outside and in, the roof covered in with flag-grass, a chimney built of stones or turf, a door and window added, the earthen floor levelled, and a coat of

West, i., 35. whitewash completed the cottage. It is said that the first house in Hobart was a wattle-and-dab hut built by Lieut. Lord on land adjoining Macquarie House. In less than two months after the *Ocean* and *Lady Nelson* had anchored in Sullivan's Cove the huts were completed and the people were all provided with fairly comfortable habitations, occupying a line from the Commercial Bank to the Hobart Club in Collins Street, and thence along the edge of the scrub to the Australian Mutual Provident Society's Building. A General Order of 17th April enjoins strict attention to the cleanliness and order of the huts, and to precautions against danger by fire.

When the huts were finished the prisoners were at liberty to work in their spare time for the officers and settlers, in clearing locations, preparing and fencing in gardens, trenching and hoeing the ground for corn or vegetables, and building houses. Labour was scarce, and the demand being greater than the supply, the work people were not slow to take advantage of the necessity by demanding exorbitant prices for their labour. The abuse became so considerable that by General Order (1st June), the Lieut.-Governor appointed a Committee composed of the civil and military officers, together with three of the settlers, to meet on Sunday after service and fix the rate of wages. The new prices for labour were promulgated by General Order of 22nd June. Mechanics for the day of 10 hours were to be paid 3*s*. 6*d*., and labourers 2*s*. 6*d*. For felling and burning timber, 30*s*. per acre; for grubbing and burning, £4 per acre; for breaking up new ground, £2 per acre. For reaping wheat, 10*s*. per acre. For sawing, 8*s*. 4*d*. per 100 feet. Splitting 7 feet palings, 3*s*. per 100; 5 feet palings, 1*s*. 6*d*. per 100. Oyster shells for lime, 3*d*. per bushel. Thatch, 6*d*. per bundle of 9 feet girth. The workmen were often paid for their labour in provisions, and the Order fixed the following equivalent rates:—Salt beef, 9*d*. per lb.; Salt pork, 1*s*.; Kangaroo, 8*d*. per lb.; Flour, 1*s*. per lb. So that for a day's work of 10 hours, a labourer could procure 1 lb. of pork and 1½ lbs. of flour, and a mechanic 2 lbs. of beef and 2 lbs. flour. Payment for labour, however, was often made in a more objectionable medium, raw spirit. At a very early period the Governor issued a stringent order against this most pernicious practice. Nevertheless, in spite of Government regulations it continued to be a crying evil, and for many a long year the abuse continued. Many a Hobart building has

Gen. Order, 27th Feb.

been paid for in rum. More could be got for spirits than for cash. A bottle of rum was long recognised currency for £1, or even a higher value. It is probable that very little labour in those early days was paid for in cash. The want of specie prevented the payment of the salaries of the officers and superintendents, and to meet this difficulty, and to supply the officers with the means of purchasing necessary articles brought by vessels coming from Sydney, the Commissary was directed to issue small promissory notes of not less than £1 sterling in value. These were to pass in circulation until specie was sent out.

Collins to Hobart, 3rd Aug. 1804.

The little camp on the hill above Sullivan's Cove must have been a grotesque and rough-looking village, with its collection of wattle-and-dab huts thatched with grass. The officers, for the most part, still occupied tents, the hospital was a marquee, and the only piece of architecture making any pretence to be a civilised dwelling was the wooden cottage of the Governor. Hunter's Island was the citadel of the colony. Here all the stores were kept in large tents under a strong guard, which, however, did not always prevent robberies. At low water the island could now be reached by the sandspit. The approach was carefully guarded, and the most minute regulations were laid down for the issue of stores and provisions, only one person at a time being allowed to come up to the store tent. Those who landed at the jetty were not permitted to make any stoppage at the island; no boat was allowed to land passengers at the jetty or come into the creek after sunset, nor was any person suffered to approach the island after that hour without a special permit from the Governor. These precautions were necessary, not only for the protection of the stores, but to secure the safety of the boats, always in danger of seizure by intending runaways. The boats were moored every night by a locked chain, a sentinel was always on guard over them, and one of the earliest works, after the completion of Government House, was the building of a boat-house for their security.

Mr. William Collins was supreme in the direction of the works in and about the island, and the Governor was already planning the erection of substantial store-houses there, in which the precious provisions and stores, on which the very existence of his little community depended, might be safely housed beyond the reach of marauders. This William Collins was a prominent man in the new colony, a position which his training as a master in the navy, his enterprising character, and his capacity and judgment fully justified. His adventurous and plucky voyage in an open boat from Port Phillip to Port Jackson with despatches will be remembered. Since that time he had done good service in examining Port Dalrymple, in company with Surveyor-General Harris and Agricultural Superintendent Clark, while the Governor was still lingering at Port Phillip undecided as to his final destination. He was now raised to the dignity of Harbour Master of the port, and was a person of no small consequence in the settlement.

6th Aug. 1804. The Lieut.-Governor, in his despatches to the Colonial Office, enlarges on the advantages of Hobart for purposes of commerce, and speaks of the spot chosen for the settlement as "a port the advantages of which, when once known, will ensure its being the general rendezvous of all shipping bound into these seas." For the present, however, merchant ships were absolutely forbidden, under severe penalties, from entering the Derwent, except in case of absolute necessity. The masters of vessels sailing from Port Jackson for Van Diemen's Land had to enter into a recognizance of £100, and two sureties in £50 each, to be forfeited if they landed any person or took any one away without the Governor's written permission. No one but the Harbour Master was allowed to board any vessel arriving in the river. These restrictions on merchant ships were not removed until the year 1813. *Sydney Gazette*, 25th March, 1804.

But while trading was thus prohibited, the development of the whale fishery, from which Hobart in after years drew so much wealth, early engaged the Governor's attention. By his desire William Collins drew up a scheme for the establishment of an extensive whaling station at Sullivan's Cove. This memorandum, which was forwarded to the Secretary for the Colonies for his approval, is well written, and shows that the Harbour Master was a man of good education and shrewd practical sense. He works out a plan for making Sullivan's Cove the centre of a South Sea sperm whale fishery,—advising on the description of the vessels to be employed, their plant and equipment, the number of men required, the mode of their remuneration by lays on the take, the necessary local superintendence, and all the details of the scheme, with an estimate of probable profits. The sperm whale season lasted from December to April. William Collins says that when the season for sperm whales and for sealing on the islands was over, the vessels could arrive in the Der- Memo. 4th Aug. 1804.

went in time to get rid of their catch, and then pursue the beach whale fishery, which commenced early in July and continued until September. During these months Storm Bay Passage, Frederick Henry Bay, and the Derwent abounded with the black whale or right fish, and a dozen vessels yearly could be freighted and sent home with their oil. The right whale was frequently seen in the Derwent in considerable numbers out of the regular season, but during the months of July, August, and September they were so numerous in the shoal parts of the river that from his tent in the camp at Sullivan's Cove he had counted as many as 50 or 60 whales in the river at one time.[*]

The Lieut.-Governor had his time fully occupied in directing the development of the settlement. Everything had his daily supervision. The planning of the buildings, the clearing of the ground, the marking off of gardens, the allotment of servants to the officers, the regulation of labour, the provisions, the stores, the punishment of offences, and the general discipline and regulation of the people, down to the smallest detail, required the personal sanction of His Honor. In addition to the care of the camp, the new Government farm demanded his constant attention, for the prosperity of the new settlement largely depended on the progress of cultivation. The intervening scrub made it difficult to reach the farm by land, and Henry Hacking, the Governor's coxswain, with his boat's crew, frequently pulled His Honor to Cornelian Bay to inspect the work of Superintendent Clark and his thirty men, who had now some 19 acres in crop, and to pay a visit to the settlers' locations a short distance beyond at Stainforth's Cove. The officers of the settlement, too, had little spare time on their hands, for the Governor was eager to get on with the public buildings, and the workmen could only be kept industrious by close and constant supervision and the strictest discipline. The Chaplain was probably the only really idle man in the camp. His professional duties were not heavy, consisting of one service and a sermon on Sundays, when the weather was fine, for there was no building large enough for the people to assemble in. Occasionally there was a burial or a marriage. During the first six months there were three weddings. On Sunday, the 18th March, Corporal Gangell of the Royal Marines was married to Mrs. Ann Skelthorn, the widow of a settler, at Governor Collins' house. On the 1st July, at the same place, Mr. Superintendent Ingle was married to Miss Rebecca Hobbs, and on the 23rd July, Mr. Gunn to Miss Patterson. But the Chaplain had plenty of idle time. His poultry yard occupied a good deal of his attention, and he chronicles his successes with sittings of eggs, and the raids made upon his hens by spotted cats, which he occasionally captured. His chief resource was his gun. During the first fortnight he shot quail in the camp, on one occasion putting up three by Mr. Bowden's marquee and bagging them. Bronzewing pigeons he sometimes shot. On the 13th March he killed his first kangaroo, adding—"the first kangaroo that had been killed by any of the gentlemen in the camp." Many a walk through the adjoining bush he took, gun in hand, and accompanied by his dog "Nettle." Sometimes he went by himself, sometimes with his man Salmon, who was a better sportsman than his master, and shot the largest kangaroo recorded as being killed on the present site of Hobart. Mr. Knopwood has preserved the weight and measurements. It weighed 150 lbs., and measured 3 feet 10 from the tip of the nose to the root of the tail, the tail being 3 feet 4 long, and 16 inches in girth at the root. Sometimes Lieut. Bowen, or some of the officers from Risdon joined the Chaplain in his shooting expeditions, more rarely Surveyor-General Harris, or Mr. Humphreys, the mineralogist. The parson's skill was scarcely equal to his zeal, for though he extended his walks as far as the Government farm and the settler's locations at Stainforth's Cove, and game was fairly plentiful, the diary often contains the entry "no success." It was not altogether the love of sport that spurred the Chaplain to these excursions—he went to shoot something for dinner. Twelve or fifteen months of salt beef and salt pork, without even vegetables, would have made a man less fond of good things than the parson long for a change, and kangaroo was greatly appreciated. Of the first kangaroo he tasted at

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[*] Knopwood in his diary (1st July) speaks of whales being so numerous in the river that his boat had to keep close along the shore, it being dangerous to venture into the mid-channel. The *Alexander* whaler, Captain Rhodes, fished in the Derwent and Storm Bay Passage from August to the end of October in this same year, and went home a full ship. There are persons yet living who can remember the time when bay-whaling, as it was called, had not ceased to be profitable. We have a reminiscence of this old industry in the name of Tryway Point, by which one of the promontories in the Derwent is still sometimes known.

Knopwood.

Knopwood.

Port Phillip, he says "and very excellent it was." He is equally emphatic as to the excellence of emu, on which he dined at Risdon. On one occasion he gave a dinner in his tent to all the civil and military officers. Here is the bill of fare:—"Fish, kangaroo soup, roast kid saddle, roast kangaroo saddle, 2 fowls pellewed with rice and bacon, roast pig." Game was plentiful at the camp, and kangaroo sold at 8*d.* per lb. Sometimes good hauls of fish were made. Soon after his landing, the Lieut.-Governor tells Lord Hobart that on the preceding day he had served out 328 lbs. of fish, thereby saving 164 lbs. of salt beef. At Risdon game was much more abundant than in the neighbourhood of the Camp. Kangaroo, emu, ducks, and black swans were very plentiful. Immense flights of black swans frequented the river above Risdon in the breeding season. The people destroyed them so recklessly that the Governor, fearing lest such a valuable resource for fresh food might be extinguished, issued an Order prohibiting their being molested during the breeding season. This first game law was one of the earliest products of civilisation. **4th Mar. 1804.** **10th March.**

We have little information respecting the numbers of the natives about the neighbourhood of the Camp. During the first week their fires were seen at a little distance, and Mr. Knopwood in his walks saw many of their huts. There is no doubt that they reconnoitred the strangers closely, but they were very shy, and only once did a party of them approach the settlement. Captain Mertho and Mr. Brown, the botanist, had an interview with them on the beach near Macquarie Point, but could not induce them to venture into the Camp. They were probably not very numerous about Sullivan's Cove—at any rate we hear nothing of such large bodies of them as visited Risdon and caused a panic on the 3rd May, when the fatal affray took place. At other places, such as Frederick Henry Bay and the Huon, they were numerous, and quite friendly with the English.

During this first year few attempts were made to explore the neighbouring country. In a former paper I noticed Mr. James Meehan's exploring trip from Risdon in the early part of 1804, by way of the Coal River to Prosser's Plains, and through the Sorell district. Of Meehan's journey there is no record, except the track of his route given in Flinders' map. The few officers at Sullivan's Cove had too much to do at the Camp to allow of their leaving it for any extended excursions. The first explorations from the Hobart settlement were made by Mr. Robert Brown,* the celebrated botanist, who had come to the Derwent with Collins' settlers, to examine the flora of Tasmania. Lieut. Bowen had ascended the river for some distance above Bridgewater, but on 5th March Mr. Brown, accompanied by Capt. Mertho and Mr. Knopwood, set out in the *Ocean's* boat on a more extended exploration. They were three days absent, and Knopwood says they reached a spot more than 40 miles from the Camp, where was an extensive plain, with very few trees—probably Macquarie Plains. Game—kangaroo, emu, and pigeons—was abundant. They saw many traces of the blacks, who, however, carefully avoided them. Towards the end of the month Brown and Humphreys, with a party provisioned for ten days, made a further attempt to reach the sources of the Derwent, but had to return disappointed. Knopwood. A few days later the indefatigable botanist set off alone through the bush, intending to go to the Huon. He was unable to get further than the North West Bay River; but on the 1st May he and Humphreys started again, and this time they succeeded in reaching the Huon, returning to the Camp after an absence of sixteen days. Lieut. Bowen had already been a short distance up this river, and had given but a poor account of the country. *Ibid.* In June, William Collins, the Harbour Master, went in the white cutter to Betsy's Island, to land two refractory convicts there, and to look out for the anxiously expected ship *Ocean*, with the rest of the people from Port Phillip. From Betsy's Island Collins proceeded up the Huon River. He was away a fortnight, and on his return reported that it was a very favourable site for a settlement, with an abundance of fresh water, good land, and fine trees. He saw many of the natives, who were friendly and took him to their camp, where there were about twenty families. Knopwood says that on this trip Collins saw three of the native "catamarans, or small boats made of bark, that would hold about six of them."

Ibid, 18 June. The only other exploration recorded is Surveyor-General Harris' survey of the Hobart Rivulet. Harris was accompanied by Mr. Humphreys, the mineralogist, and three men. They followed the rivulet to its source, and thence went to the top of the mountain. The old plan which I have mentioned was probably the result of this survey.

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* Robert Brown was a botanist of European reputation, and his "Prodromus Floræ Novæ-Hollandiæ et Insulæ Van Diemen(London, 1810], is still a standard work. He arrived at the Derwent in the *Lady Nelson* early in February, 1804, and returned to Port Jackson in the *Ocean*, 9th August in the same year.

It will be remembered that when the Lieut.-Governor removed his people to Sullivan's Cove, he did not interfere with Lieut. Bowen at Risdon, but left that officer in charge at the site chosen by him in the previous September. It was not until after Lieut. Moore's fatal affray with the blacks (3rd May) that Collins took over the command of the unlucky first settlement, and removed the people to Sullivan's Cove preparatory to their being sent back to Port Jackson. The Risdon colony had been named "Hobart," under instructions from Governor King, and, on the abandonment of that place, Collins appropriated the name, and called his new settlement at Sullivan's Cove "Hobart Town." This name it retained until 1881, when the Legislature dropped the superfluous "Town," and reverted to the simple original designation "Hobart." The name "Hobart Town" first appears in a General Order of 15th June, 1804. Hobart Town was henceforth the official designation of the colony; but the memory of the first encampment lingered long with the early settlers, and at that time, and for long years afterwards, even as late as the year 1825, the new town at Sullivan's Cove was familiarly known as "The Camp."

The Lieut.-Governor had now been settled at the Derwent for four months, and as yet had only half his establishment with him. The *Lady Nelson*, after landing the settlers and the stores, had sailed for Port Jackson early in March, and before the end of the month the *Ocean* also had left for Port Phillip to bring Lieut. Sladden and the remainder of the people. The *Ocean* might have been reasonably expected to be back in a month at furthest; but week after week went by, April and May had passed, June was well advanced, and yet there was no sign of the missing vessel. The Governor grew very anxious, and almost made up his mind to give her up for lost. The Harbour Master was sent at intervals to Betsy's Island to look out for her, but returned without news. At last, on the 22nd June, the Governor's fears were set at rest by her appearance in the river. Lieut. Johnson landed, and reported that they had been 33 days on the voyage, during which they had had violent gales, the ship having been under bare poles for days at a time, the captain hour by hour expecting her to founder. It took her three days to come up the river,

Knopwood, 6th March.

24th March.

making her total passage 36 days. The misery and semi-starvation of those wretched five weeks, during which they were cooped up and tossed about in that little vessel of 480 tons, were not soon forgotten by her 160 passengers. The live stock brought in the *Ocean* also suffered severely during the long rough passage, and Collins ruefully enumerates the losses, which he could ill afford, seeing that the whole of the live stock at the settlement at the end of July consisted of only 20 head of cattle, 60 sheep, and some pigs, goats, and poultry.

The reinforcement of people he had received now brought up the strength of the Governor's establishment to 433 persons—viz., 358 men, 39 women, and 36 children.* The new arrivals were temporarily distributed amongst the huts already built, and the considerate Governor allowed them a few days' exemption from work to enable them to build themselves houses. He was so pleased with Lieut. Sladden's report of his little detachment of marines that he issued a Garrison Order commending them, and expressing his gratification at their soldierlike demeanour. His civil staff was now complete. Mr. Leonard Fosbrook, the Deputy Commissary-General, who had been left at Port Phillip in charge of the stores and live stock, was quartered in a marquee on Hunter's Island. Three magistrates were appointed under a Commission from the Governor-General King. This first Tasmanian Commission of the Peace consisted of the Rev. Robert Knopwood, Lieut. Sladden, and Surveyor-General Harris. The night watch was also reorganised, and placed under the direction of Mr. Wm. Thos. Stocker, who in after years became a respected citizen of Hobart as the proprietor of the best inn in the town, the *Derwent Hotel*, situated in Elizabeth-street, on the spot now occupied by Mr. Henry Cook's tailors' shop. Collins was not altogether satisfied with this night watch, for he had to complain of frequent robberies, which he characterised as a disgrace to the settlement, and which he was of opinion could not have been perpetrated if the watch had been properly vigilant. Such irregularities were, no doubt, inevitable

Gen. Order, 29th June.

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* The return is printed in the Appendix. It bears date July, 1804, and is, presumably, the record of the muster taken about three weeks after the *Ocean's* arrival, and referred to in General Order, 17th July. It does not include Lieut. Bowen's Risdon people, who were separately victualled. A comparison of figures leads to the belief that it does include the few prisoners selected from the Risdon establishment, and whom Collins retained at the Derwent.

with the class of people the Governor had to control; but, for all that, the community, taking all things into consideration, seems to have been fairly orderly and well behaved, and to have been free from the flagrant abuses and general demoralisation which disgraced the early years of the Port Jackson settlement, and which afterwards sprung up in this colony under less capable governors than Collins.

That Collins must have had first-rate qualities as a ruler is evidenced by the fact of the rapid progress made by the colony during the first six months of its existence—from February to the beginning of August—the time covered by the present paper. When, on the 9th August, 1804, the *Ocean* sailed for Port Jackson with Lieut. Bowen and the rest of the Risdon people, whom the Governor was so glad to be rid of, the new settlement at Sullivan's Cove was already organised, and with every prospect of permanent success.

After the lapse of well nigh a century, we, the inhabitants of the fair city which has arisen on the site of the Camp of 1804, would show ourselves strangely unmindful of what we owe to the past if we did not hold in honour the name of David Collins, and if we failed to keep in grateful remembrance the sagacity and energy which he, our first Lieut.-Governor, displayed in the founding of Hobart, 85 years ago.

APPENDIX.

RETURN of Inhabitants at the Derwent River, Van Diemen's Land, July, 1804.

	Men.	Women.	Children.
Civil Department	18	5	9
Military Department	48	9	3
Prisoners	279	2	...
Prisoners' wives and children...	...	16	8
Settlers	13	7	16
	358	39	36
TOTAL		433	

NOTE.—This return does not include the people belonging to Lieut. Bowen's Risdon Settlement, who were sent back to Port Jackson by the Ocean, 9th August, 1804.

FREE SETTLERS.

The names of the free settlers were sent with a letter of April 5th, 1803, from Mr. Sullivan to Lieut.-Governor Collins.—Labilliere's "Early History of Victoria," i., 148.

"*LIST of Persons who have obtained Lord Hobart's permission to proceed to Port Phillip.*

Names.	Occupations.	Remarks.
Mr. Collins	Seaman	
Edw. Newman.......	Ship carpr.	
Mr. Hartley	Seaman	
Edwd. F. Hamilton.		
John J. Gravie.		
Mr. Pownall.		
A female servant.		
Thos. Collingwood	Carpenter	
Duke Charman.		
John Skilthorne ...	Cutler	
Anty. Fletcher......	Mason	
T. R. Preston	Pocket-book maker."	

[This list is incomplete.]

RETURN of the Officers, Superintendents, and Overseers belonging to the Civil Establishment at Hobart Town, River Derwent, Van Diemen's Land. [*July*, 1804.]

Names.	Appointments.	Where disposed.	Date of Appointment.
David Collins, Esq.	Lt.-Governor	At Hobart Town	
Rev. Robt. Knopwood	Chaplain	Ditto	
Benjn. Barbauld[1]	Depty. Judge Advocate	In England on leave	
Wm. I'Anson	Surgeon	At Hobart Town	
Mattw. Bowden	1st Asst. Surgeon	Ditto	
Wm. Hopley	2nd Asst. Surgeon	Ditto	
Leond. Fosbrook	Depy. Commissary	Ditto	
Geo. Prid. Harris	Depy. Surveyor	Ditto	
A. W. H. Humphreys[2]	Mineralogist	Ditto	
Wm. Collins[3]	Harbour Master	Ditto	2 April, 1804
Thos. Clarke	Superintendent	At Farm Bay	
Wm. Patterson	Ditto	At Hobart Town	
Wm. Nicholls[4]	Ditto	Ditto	21 Jany. 1804
John Jubal Sutton[5]	Ditto	Ditto	27 Feby. „
Richd. Clark[6]	Ditto	Ditto	1 June „
John Ingle[7]	Overseer	Ditto	
Wm. Parish[7]	Ditto	Ditto	

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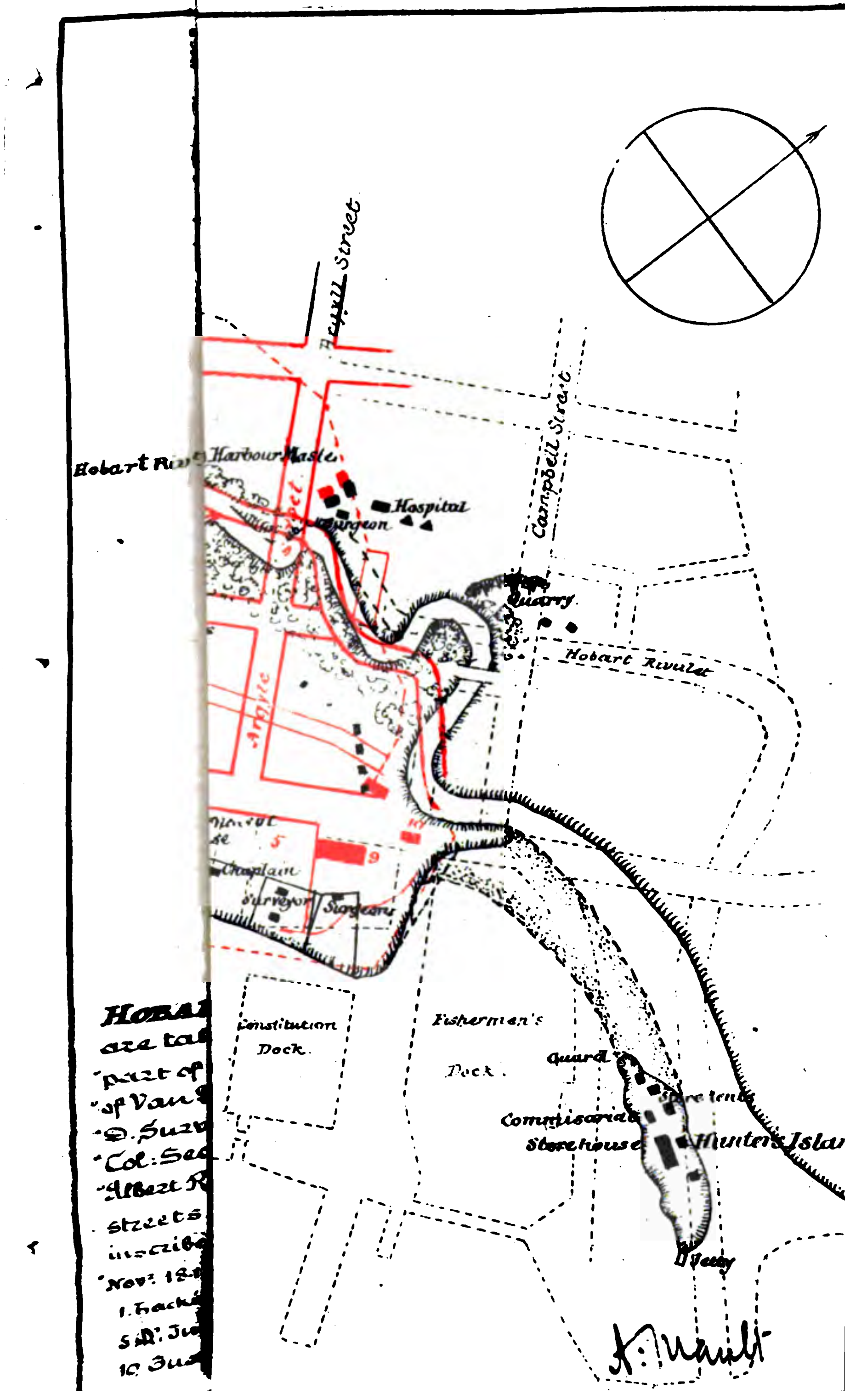
[1] Mr. Barbauld never came out to the Colony. [2] Afterwards Police Magistrate at Hobart. [3] Came out as a free settler. [4] Came out as a free settler; appointed Superintendent of Carpenters at Port Phillip. [5] Came out as Corporal of Marines. [6] Came with Lt. Bowen to Risdon in Sept., 1803, as a free settler; appointed Superintendent of Masons. [7] Appointed at Port Phillip; seem to have been free settlers.

QUARTERLY employment of the Prisoners in His Majesty's Settlement, Derwent River, Van Diemen's Land, July, 1804.

Agriculture and Stock.		
Overseers	2	
Agriculture on the public account	28	
Care of Government Stock	5	
	—	35
Buildings.		
Stone Cutters and Masons	3	
Sawyers and Timber Measurer	11	
Carpenters and Labourers	11	
Blacksmiths, Armourer, Tinman, and File Cutter...	8	
Lath and Pale Splitters	2	
Bricklayers, Plasterers, and Labourers	10	
Lime and Charcoal Burners	5	
Timber Carriage	26	
	—	76
Boat Builders, &c.		
Shipwrights and Caulkers	3	
Labourers	1	
	—	4
Various Employments.		
Clerks	2	
Overseers	7	
Taking care of Government Huts	4	
Public Stores and Cooper at ditto	5	
Boats' Crews	21	
Government Gardens	7	
Town Gang	38	
Night Watch	7	
Attending Hospital	6	
Bellringer and Barbers	3	
Tailors and Shoemakers	6	
Printer	1	
Thatchers and Toolhelver	5	
Cook, Baker, and Drummers to the R. M. Detachment	4	
Jail Gang	1	
Tanner and Gluemaker	1	
	—	118
Servants.		
To Commissioned Officers, Civil and Military	21	
To Superintendents and Overseers	8	
To Non-commissioned Officers of the Royal Marines	2	
To Settlers	1	
	—	32
Sick and Convalescent		14
TOTAL		279


Argyll Street
Campbell Street
Hobart Rivulet
Harbour Maste
Hospital
Surgeon
Argyle
Quarry
Hobart Rivulet
5
9
10
Chaplain
Surveyor
Sergeant
Constitution Dock
Fisherman's Dock
Guard
Store tents
Commissariat Storehouse
Hunters Island
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D. Sur
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5 Dr. Ju
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RETURN of Live Stock in His Majesty's Settlement, Derwent River, Van Diemen's Land, 4th August, 1804.

To whom belonging.	Horses.	Cattle.	Sheep.	Goats.	Pigs.	Fowls, Geese, Ducks, and Turkeys.
Government	...	21	39	...	15	...
Lieut.-Governor Collins	...	...	1	...	20	37
Military Officers	...	...	...	2	5	22
Civil Officers	...	...	12	13	7	36
Settlers and others	...	...	9	3	9	83
	0	21	61	18	56	178

DISCUSSION.

Mr. **NICHOLAS BROWN** said the very clear historical account they had been listening to formed a very fitting sequel to the papers which Mr. Walker had previously read and which he was glad to say had been printed as a Parliamentary paper. He was very pleased that Mr. Walker had dealt with these matters in such an interesting way, and he thought they were all amply rewarded for any expense which had been incurred by employing Mr. Bonwick in collecting the information, and they were especially indebted to Mr. Walker for the way in which he had handled the subject.

Mr. **McCLYMONT** thought it would be a good thing if the papers were published in a more popular form than as a mere record of the Society's proceedings.

Mr. **WALKER** said there was a large number of the early documents relating to Tasmania, and the Society might endeavour to get the Government to publish a selection of them. Another thing he hoped was that the Government would continue to employ Mr. Bonwick collecting these documents. He had only gone as far as 1806, and he might go on to the death of Collins through Governor Davey's term of office, and possibly part of Sorell's. As the settlers went through some very great privations a selection of these documents, if published, would be of very great interest and value.

Mr. **R. M. JOHNSTON** thought if the sequence of papers which Mr. Walker had undertaken to prepare were published in the form of a hand-book they would be better for general reference and become more popular. If the series of papers were reproduced in this form they would be much better and more valuable than publishing a few disconnected documents.

NOTES ON A GRUB FOUND INFESTING THE ORCHARDS OF HOBART, WITH A FEW REMARKS ON THE SUBJECT OF INSECT PESTS GENERALLY.

By Alex. Morton, F.L.S.

On the 9th of November I received a number of cherries from Mr. R. Walker, of Hobart, which were infected with a small grub. After examination, I am led to believe that the grub is identical with a native of the United States, known there as the plum curculio (*Conotrachelus nenuphar*), of the family Curculionide. I understand it was first noticed about Hobart last year, but has enormously increased since its first approach, and is attacking the best kinds of cherries, such as the Florence and Bigaroo. It is so destructive that the most vigorous measures should be taken by orchardists in whose gardens it appears to prevent it spreading to places as yet free from its ravages. From William Saunder's "Insects injurious to fruit," I extract the following:—"This insect is, without doubt, the greatest enemy the plumgrower has to contend with, for when allowed to pursue its course unchecked it often destroys the entire crop. The perfect insect is a beetle belonging to a family known under the several names of curculios, weevils, and snout beetles. It is a small, rough, greyish, or blackish beetle, about one-fifth of an inch long, with a black shining hump on the middle of each wing case, and behind this a more or less distinct band of a dull ochre yellow colour, with some whitish marks about the middle. The snout is rather short. The female lays her eggs in the young green fruit shortly after it is formed, proceeding in the following manner: Alighting on a plum, she makes with her jaws, which are at the end of her snout, a small cut through the skin of the fruit, then runs the snout obliquely under the skin to the depth of about one-sixteenth of an inch, and moves it backward and forward until the cavity is smooth and large enough to receive the egg to be placed in it. She then turns round, and dropping an egg into it, again turns and pushes it with her snout to the end of the passage. Subsequently she cuts a crescent-shaped slit in front of the hole so as to undermine the egg and leave it in a sort of flap, her object apparently being to wilt the piece around the egg and thus prevent the growing fruit from crushing it. The whole operation occupies about five minutes. The stock of eggs at the disposal of a single female has been variously estimated at from 50 to 100, of which she deposits from 5 to 10 a day, her activity varying with the temperature. In warm and genial weather it will hatch in 3 or 4 days, but in cold and chilly weather it will remain a week or even longer without hatching. The young larva is a tiny and footless grub, with a horny head. It immediately begins to feed on the green flesh of the fruit, boring a tortuous channel as it proceeds until it reaches the centre, where it feeds around the stone. It attains its full growth in from 3 to 5 weeks, when it is about 2-5ths of an inch long, of a glassy yellowish-white colour, with a light brown head, a pale line along each side of the body, a row of minute black bristles below the lines, a second row, less distinct, above, and a few pale hairs, towards the hinder extremity. The insect is single brooded, the beetle hibernating in secluded spots, under the loose bark of trees, and in other spots. Besides the plum, the peach, nectarine, and apricot also suffer much from its attacks, and it is very injurious to the cherry. When the plum curculio is alarmed it suddenly folds its legs close to its body, turns the snout under its breast, and falls to the ground, where it remains motionless, feigning death. Advantage to be taken of this peculiarity to catch and destroy the insect, a sheet to spread under the trees, and the tree and its branches are suddenly jarred, when the beetles fall on the sheet, where they may be gathered up and destroyed." This extract will sufficiently show the serious nature of the new invasion, and it seems to me of sufficient importance to sound a note of alarm on the subject. How can we best deal with the insect pests that are injurious to fruit? The question must be answered if the fruitgrowing industry is to live, and answered in a vigorous and indisputable fashion, or the industry will utterly perish. We have in our midst not one pest but many, and though some of the fruit inspectors have a general knowledge of the codlin moth, there is probably not one qualified to deal with any new pests that may be developed. What we need is to have one competent practical entomologist, with a knowledge of actual orchard work, to take charge of the entire department, make such regulations as he may see to be necessary, and be responsible only to Parliament. As no country in the world has paid so much attention to the subject as America, it might be necessary to send there for the man we require, but no time should be lost in setting in motion the machinery for the subjugation of our insect foes. Another aspect of the same subject is the danger we incur in importing fruit from the United States. When we know that in America there are 210 species of insects known to be injurious to apples, the gravity of the danger in introducing American fruit to Tasmania may be understood. Dr. Packard, a well-known entomologist, has estimated that there are within the limits of the United States 50,000 species of insects; another writer says, that of the 325,000 species of insects known to exist by name and description, 25,000 belong to the United States. Of these 15,000 at least would be regarded as injurious, from preying upon material serviceable to man. Of these 7,000 or 8,000 may justly be regarded as fruit destroyers. A writer in America, referring to the increase in insect pests, thus writes:—"The fruitgrower can no longer ignore the insects as insignificant objects in nature almost unworthy of regard. The myriad hosts confront him on every side, and demand his attention. They claim the choicest products of his labour, not a tithe of them, which might, perhaps, be granted, but the entirety. It is a struggle for mastery, in which he must conquer the insect, or the insect will conquer him." It is to be hoped that Parliament will seriously consider this matter and devise prompt measures, in the interests of the whole colony, for the eradication of enemies that seriously threaten one of the most important industries in Tasmania. In the meantime, let the orchardists bestir themselves and remove the breeding grounds that many of them considerately leave to encourage the growth and spread of insects. Let them see to it that no long grass or weeds are allowed to grow in their orchards, that all trees are planted at a considerable distance from fences or fallen timber, and that ali rubbish in the orchard be promptly and constantly burned. Then the pests would be kept at any rate within manageable limits, and the losses would be considerably reduced. With a view of studying the development of the Curculio, and any other insects that infest Tasmanian orchards, Mr. Creswell, the Chairman of the Hobart Fruit Board, has kindly promised to be good enough to have forwarded to me grubs in different stages of development, and at different seasons, and am about procuring a case for their reception, in which their changes and development may be noted. I have also written to several prominent entomologists in America on the matter, and hope during next session to give some further information on the subject.

THE PRESIDENT'S ADDRESS.

Fellows of the Royal Society of Tasmania,—Following the precedent of the last two sessions, during which I have had the honour of holding the office of your President, I now proceed, on this our closing meeting for 1889, to sum up briefly the results of the session. The number of our Fellows has increased since last year, and the additions to our library have been most satisfactory. The attendance at our meetings has been much larger than in previous sessions, and owing mainly to the general interest attaching to many of the papers submitted, and, perhaps, to some extent, to a suggestion I made at our opening meeting, more members have taken part in the discussion of papers than has hitherto been the case, and in this way our meetings have been made more lively and interesting. And here I must say one word in commendation of the full and accurate reports which the Press have been good enough to give of our proceedings, and I am happy to place on record the fact that I have found persons in all parts of the island taking a deep interest in what goes on at our meetings, of which they would have known nothing except from the reports in the newspapers.

The close association of our Society with the Museum, with which we have many objects in common, justifies me in referring to the very important addition made during the session to the accommodation of the Museum by the opening of a new wing. It will be in your recollection that it was at a meeting held in this room on 22nd May last that I performed the pleasing duty of declaring this new wing to be open. On that occasion I referred to the excellence of the description and classification adopted by our Curator, and since that time Professor Flower, F.R.S., the President of the last meeting of the British Association held at Newcastle-on-Tyne on September 11, devoted a considerable portion of his address to pointing out the extreme importance of the classification and descriptions of specimens in Museums. He goes so far as to say that a well-arranged Museum should be "a collection of instructive labels illustrated by well-selected specimens." The Curator, he says, "must carefully consider the object of the Museum, the class and capacities of the persons for whose instruction it is founded, and the space available to carry out this object. He will then divide the subject to be illustrated into groups, and consider their relative proportions, according to which he will plan out the space. Large labels will next be prepared for the principal headings, as the chapters of a book, and smaller ones for the various sub-divisions. Certain propositions to be illustrated, either in the structure, classification, geographical distribution, geological position, habits, or evolution of the subjects dealt with, will be laid down and reduced to definite and concise language. Lastly will come the illustrative specimens, each of which, as procured and prepared, will fall into its appropriate place. As it is not always easy to obtain these at the time they are wanted, gaps will often have to be left, but these, if properly utilised by drawings or labels, may be made nearly as useful as if occupied by the actual specimens." He says further :—"A local collection, illustrating the fauna and flora of the district should be part of every such museum." This description of what a museum should be exactly accords with the method pursued by our Curator, and I think it is a matter of which we may well be proud, that we have been for some time and are now proceeding in this respect upon the exact lines laid down by so great an authority as Professor Flower. I have, perhaps, now spoken of the Museum as far as is admissable on an occasion of this sort, but as I have referred to the addition of the new wing, I cannot pass over in silence the appropriation of part of it to form the nucleus of an Art Gallery, and I am sure you all unite with me in hoping that this may develop and increase the taste and love for art amongst us.

We have held eight meetings this session, and have had some very admirable papers submitted to us. On our first meeting Mr. Benson read a very interesting paper on the question of popularising scientific societies by supplementing, not by subverting, their work, and while our Society, who have carefully considered this matter, have not yet seen their way to give effect to Mr. Benson's excellent suggestion, it is satisfactory to note that, under the auspices of the Technical Education Board, several interesting popular lectures, which have been well attended, have been delivered in connection with such scientific subjects as "Human Physiology," "Chemistry," and "Art in Relation to Construction." Acting upon a suggestion of mine made some time ago that our Society might deal with a wider range of subjects, Mr. Johnston has submitted to us to-night a very elaborate paper, and a very able paper, as all his papers are, on "Root matters in social and economic problems." This subject is far too wide, covering as it does the whole range of economic science, to admit of discussion without much study and consideration, but I hope that next session we may have some interesting discussions upon it.

In Geology we have had papers on "The Iron Blow at the Linda Gold-fields," by Mr. G. Thureau and Mr. R. M. Johnston, and on the discovery of a fossil fish by Mr. R. M. Johnston and Mr. A. Morton, which they did me the honour to name after me, *Acrolepis Hamiltoni.* Mr. Johnston also laid before us a paper supplementary to one previously submitted by him, giving additions to the list of Upper Palæozoic fossils.

In ornithology Col. Legge submitted a paper on the Australian Curlew, and Mr. Morton called attention to one or two rare birds, of which specimens have recently been obtained for the Museum.

In astronomy we have had papers from our valued contributor, Mr. A. B. Biggs, on "A new dark field micrometer for double star measurements," or "Observations of the comet of July and August, 1889, taken at Launceston," and on recent measurements of "*a* Centauri."

An interesting question respecting smut in grain was raised by a letter from Mr. Joseph Barwick, and was commented on in papers submitted by Mr. F. Abbott and Mr. T. Stephens; and another question raised by the same gentleman (Mr. Barwick) respecting the value, probable extent and source of supply of the salt to be found in what is known as the Salt Pans in the Midland district, gave rise to some interesting discussion.

Mr. J. H. Maiden, Curator of the Technological Museum, Sydney, a corresponding member of our Society, was good enough to send us a paper on Australian and Tasmanian Sandarach, pointing out its value as an article of commerce.

Dr. Hardy read a paper on a case of poisoning of a child by eating a portion of the trumpet lily flower, in which he suggested that much valuable information, from a medical point of view, might he obtained from an investigation into the properties of the Australian flora. I ventured last year to appeal to the medical fellows of our Society to do some work for us, and I hope that next session we may have further contributions from Dr. Hardy, and also from other of our medical friends.

We have had to-night some valuable notes, by Mr. A. Morton, on an insect found infesting the orchards of Hobart, with a few remarks on the subject of insect pests generally, a matter of great importance in a fruit-growing community like ours.

At our June meeting a very interesting letter was read from the Hon. Stanley Dobson on the height of trees, pointing out that in Victoria this had been greatly exaggerated, and asking for information as to the highest Tasmanian trees. Our Society thereupon addressed a circular to several persons living in different districts where large trees grow, but although we have had many communications in reply to our request, we have not yet received authentic information of any existing tree exceeding 331ft. in height. I would ask every one who may read these remarks, who is in a position to send authentic measurement of any tree exceeding this height to be good enough to do so. Mr. E. A. Counsel, the Deputy-Surveyor General, has also instructed his surveyors, whenever possible, to find the elevation of any unusually large trees they come across, and to furnish the result to this Society.

Mr. James Andrew submitted a very suggestive paper on Angora goat farming, and this was followed by an interesting letter on the subject from Mr. J. Smith, of Westwood. I hope the attention called to this subject by our proceedings may lead to the utilisation in this way of some of our rough mountainous and scrubby country, which is practically valueless for feeding sheep or cattle.

Mr. Johnston, whose range of subjects is about as wide as our Society itself, submitted a paper on pyramidal numbers, which seemed to me, as I listened to it, to be more ingenious than the most ingenious puzzle, but I feel sure when it comes to be studied, that like all his work, it will be a worthy addition to the proceedings of the Society.

Our respected Vice-President, Mr. Barnard, laid before us a most interesting paper on the last living aboriginal of Tasmania. Mr. Barnard's long connection with this Society has taught him the true method of scientific inquiry, viz., to take nothing for granted, even although accepted by the bulk of opinion, and to give categorically his own reasons for his conclusions. We all hope the Society may long continue to receive papers from him.

Captain Shortt read an interesting paper on the possible oscillation of levels of land and sea in Tasmania, and he submitted a chart to us showing the registration of temperature by a self-registering thermometer recently received from Paris. This instrument will no doubt become of great value, as it shows the precise time of each day at which the greatest heat and cold are experienced, and also the duration of the varying temperatures during the 24 hours, which cannot be ascertained from the present maximum and minimum thermometers. We hope we may have a paper from him on this subject next session.

Mr. Mault read a paper on certain tide observations taken at Hobart during February and March, 1889, which showed some very curious irregularities, and the thanks of our Society are certainly due to him for the trouble he has taken in getting copies for us of the old charts of Tasmania.

Mr. McClymont read a most curious paper, illustrated by charts, of the misconceptions existing in early times respecting the *terra Australis*, and gave some very ingenious explanations of how they had arisen.

Then last, but by no means least, we have had the three excellent papers by Mr. J. B. Walker on the early settlement of Tasmania. The first, following up his paper of last session on the early visits of the French to this island, deals with the English at the Derwent and the Risdon settlement. The second deals with the settlement under Collins in 1803-4, and the third, which we have heard to-night, with the first settlement at Hobart. It is impossible to attach too great importance to an authoritative compilation from official documents of the early history of the land in which we live, and it is meet and fitting that such a compilation should take its place on the records of our Society. It certainly is well worthy of consideration whether a popular handbook of the early history of Tasmania might not be compiled from these interesting papers of Mr. Walker's.

It is too early yet to speak of the results which we hope will follow from the generous gift of Dr. Agnew to the colony of the large quantity of salmon ova which Sir Thomas Brady brought out, and which are being distributed under the auspices of a committee of this Society, but it may be interesting to refer to the fact which I have already brought under the notice of this Society, that marked variations exist in the characteristics of the young salmon even before their liberation from the Salmon Ponds, and to the fact that specimens showing these variations have been obtained, which will be sent to experts in the Old Country. We had hoped to have welcomed Dr. Agnew amongst us this evening, and we all regret his absence, for no individual member has done more to secure the advancement of this Society than Dr. Agnew.

I think, gentlemen, we may regard with satisfaction the work of this session. Our best thanks are due to those gentlemen who have done work for us, and have taken part in our discussions, but still I should like to see more work done, and more of our Fellows doing it. Since last session a great step in advance has been taken by the colony in founding a school for technical instruction, and I trust and hope that the facilities afforded to the rising generation of Tasmanians for the study of science will help in time to come to raise up an army of workers for this Society who will greatly add to its success and usefulness. It is our earnest hope and desire that this Society may flourish more and more. I need not commend it to those who love science for its own sake, but those whose other avocations may not permit of their personally devoting time to research, or who may not have any bent in that direction, will nevertheless by attendance at its meetings and studying its proceedings, derive much pleasure and profit, and experience a relaxation from their daily work which carries no enervating tendencies with it. While to those who judge everything from a material standpoint, I would say, Do not forget that many of the investigations of science, which is a main business of societies like this, lead directly and indirectly to the opening up of new industries, and to the development of existing ones, while they contribute much to the comfort and, sometimes, even to the extension of the duration of human existence.

MR. JAMES BARNARD, V.P., said we have all, I am sure, listened with equal pleasure and profit to the highly interesting address with which we have been favoured by His Excellency the President, reviewing the work of the Royal Society during the session about to close; and, if I interpret aright the feelings and wishes of the Fellows present, they would desire not only to thank His Excellency for his valuable paper, but also to acknowledge their deep obligations to him for the unceasing interest which he has shown in the Royal Society, as well as for so regularly attending its evening meetings.

Three sessions have now passed since His Excellency's assumption of the Chair of the Society as its official President; and I think it will not be denied that His Excellency has amply fulfilled his expressed intention of attending all the meetings he could, for I believe it has only been on some two or three occasions during the whole of this long period that His Excellency has been absent, and then arising from some unavoidable cause.

And here I cannot refrain from remarking upon an innovation —and that of an especially gratifying character—which we owe to His Excellency, and that is the admission of ladies to our evening meetings, and which has procured for us the pleasure of the frequent presence of the accomplished lady who is at the head of society in Tasmania, and thus reviving the practice that prevailed at the meetings of the original Tasmanian Society more than forty years ago, at which that noble woman Lady Franklin was invariably present.

Digressing for a moment to another subject, I would observe that in politics intercolonial federation is believed to be the dream of colonial statesmen; but in science we have the satisfaction of knowing that federation has been already attained by the "Australasian Association for the Advancement of Science," which has gathered into its ranks and welded into one body representatives from all the several scientific societies of Australia and New Zealand: and here I may remark that our Royal Society is to be congratulated that it is sending to that Association early in January one of its most distinguished members, who is second to none in scientific acquirements, and who has been selected by the Council of that Association to be the President of an important section in the programme for the year.

But I have been getting off the rails, and must now come back to the pleasing duty which I have undertaken, and that is to offer to His Excellency the President our best thanks for his admirable closing address of the session, as well as our hearty acknowledgments of the eminent services which His Excellency has rendered to the Royal Society during the past three years.

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Oct. 13

PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR

1890.

TASMANIA:
PRINTED AT "THE MERCURY" OFFICE, MACQUARIE ST., HOBART

1891.

REPORT

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1890.

Tasmania:
WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1891.

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MINUTES of the Annual General Meeting of the ROYAL SOCIETY OF TASMANIA, *held at the Museum on Friday evening, 12th March,* 1891,—*Mr.* JAMES BARNARD, *Vice-President, in the Chair.*

NEW MEMBERS.

Mr. J. J. Walker, R.N., Chief Engineer of the *Penguin*, was elected a Corresponding Member.

Captain P. R. H. Parker, R.N., and Messrs. E. Watchorn, John Brown, and Montague Jones were elected Fellows.

THE ANNUAL REPORT.

The Secretary (Mr. A. Morton) read the Annual Report.

Sir Lambert Dobson moved—That the Report now read be adopted, printed, and circulated among the Fellows of the Society. He said that the Report really spoke for itself; but in the slight reference he would make to it he would like to say one word in reference to the great interest taken in the progress of the Society by His Excellency the Governor. He thought that, in the absence of Sir Robert Hamilton, they might very fairly pay a tribute to the generous and warm interest he had taken in the Society. His Excellency had hardly ever failed to be present, and he had not only manifested a personal interest, but had given the Society, as a present, a very valuable work. They were also indebted to those gentlemen whose names appeared as having read papers at the meeting of the Society, their only regret being that they had not a larger number of contributors, and the work distributed over more shoulders. He thought that they had reason for congratulation at the progress of the Society, both numerically and financially, and he had no doubt but that much of that success was due to the Secretary. He mentioned that gentleman specially because he had worked hard, and done good work for the Society. He believed that there was much to be done in the walks of science here. A naturalist on board H.M.S. *Penguin* had discovered many species of new insects since the ship had been in the harbour, and doubtless many more might be discovered if there were in our midst those who followed such pursuits.

Mr. F. Jacobs seconded, and the motion was passed.

Mr. E. D. Swan moved—That the Hon. J. W. Agnew, M.D., His Honor Sir Lambert Dobson, Messrs. Russell Young, and C. H. Grant, the retiring Members of the Council, be re-elected; also that Messrs. Francis Butler and John Macfarlane be re-elected as Annual Auditors.

Mr. F. Abbott seconded, and the motion was passed.

Mr. Francis Abbott moved—That a vote of thanks be accorded to Messrs. Butler and Macfarlane for their kindness in acting as Auditors during the year.

Mr. A. W. Gosnell seconded, and the motion was agreed to.

Mr. C. H. Grant moved—That a vote of thanks be accorded to the Press for their valuable services in publishing such full and accurate notes of the Society's proceedings.

Dr. Bingham Crowther seconded, and the motion was agreed to.

This finished the business.

REPORT.

The Council of the Royal Society of Tasmania have much pleasure in submitting the following Report for 1890 :—

The first monthly meeting took place on April 22nd, when the President, His Excellency Sir R. G. C. Hamilton, K.C.B., occupied the chair. The attendance of Fellows, including several ladies, was large. Mr. James Barnard gave an account of the visit of the Representatives of this Society to the Melbourne meeting of the Australasian Association for the Advancement of Science. Mr. J. B. Walker read an interesting paper on the "Discovery and Occupation of Port Dalrymple." Mr. R. M. Johnston presented a joint report from himself and Mr. A. Morton on a ganoid fish from the lower mesozoic sandstones near Tinder Box Bay; and Mr. A. Durrand, F.R.M.S. London, exhibited a series of fine microscopical preparations of foraminifera and other minute organisms dredged from depths of from five fathoms to two miles, near the coasts of the Hawaian Group, Java, the Channel Islands, Ireland, &c. The number of papers read during the session was twenty-three. The subjects were :—

By Mr. J. B. Walker.

1. "The Discovery and Occupation of Port Dalrymple."

2. "An Account of the last Antarctic Expedition."

3. "Notes on the localities mentioned in the Journal of Tasman's discovery of Tasmania."

By Mr. R. M. Johnston, F.L.S.

4. "Description of a second Ganoid Fish from the mesozoic sandstones near Tinder Box Bay."

5. "Further observations upon the Fishes and Fishing Industries of Tasmania, together with a revised list of indigenous species."
6. "Root matters in Social and Economic Problems."
7. "Provisional aid to the study of the Tasmanian Mollusca."
8. "Notes on a Fern new to Tasmania *(Blechnum cartaligenum.)*"
9. "Observations on the influence of Strikes upon Real Wages."
10. "A rejoinder to Mr. A. J. Ogilvy's paper, entitled 'Can the toiling masses really improve their condition by Strikes?'"

By Mr. E. C. Nowell.

11. "Do the changes of the moon affect the rainfall?"

By Captain Shortt, R.N.

12. "A rejoinder to Mr. Nowell's paper."

By Mr. A. Morton, F.L.S.

13. "Notes on a recent dredging trip in the Derwent."
14. "What Science and Commerce may gain from an Antarctic Expedition."
15. "A complete list of Ferns found in Tasmania, with full descriptions of the genera and species."

By Mr. A. J. Taylor.

16. "On the coco-de-mer *(Lodoicea seychellarum)*."
17. "Notes on the Native Hop *(Daviesa latifolia)* as a cure for Hydatids."

By Wm. Montgomery, M.A., Government Geologist.

18. "Notes of some geological observations on the West Coast."

By Mr. A. T. Urquhart, Corresponding Member.

19. "Description of some new Tasmanian Spiders."

By Mr. James Andrew.

20. "Notes on Ostrich Farming."

By Mr. A. J. Ogilvy.

21. "Can the toiling masses really improve their condition by these incessant and unhappy Strikes, or are they only beating their hands against the iron bars of inexorable economic law?"

By C. E. Barnard, M.D.

22. "Actinomycosis and Tuberculosis."

By Baron Mueller.

23. "Notes on a new Tasmanian plant of the order Burmanniaceæ."

It will thus appear that original work of a valuable character, especially in reference to the Natural History of Tasmania, has been done during the session; and it is satisfactory to report that the annual volume will very soon be ready for distribution.

COUNCIL.

No change has taken place during the session.

LIBRARY.

The most noteworthy circumstance in connection with the Library has been the very liberal donation by His Excellency of the recent (9th) edition of the "Encyclopedia Britannica," 24 vols. Dr. Agnew also presented the Report of the scientific results of the voyage of H.M.S. *Challenger* during the years 1873–6, in three volumes.

FELLOWS.

Seventeen Fellows and two Corresponding Members have been elected; nine have resigned.

FINANCE.

The income has been—Subscriptions to Royal Society, £189; fixed deposit, £323 8*s*. 9*d*.; interest, £5 15*s*.; total, £518 3*s*. 9*d*. Expenditure, £244 2*s*. 9*d*.

STATEMENT of the Funds of the ROYAL SOCIETY *for the Year* 1890.

Receipts.	£	s.	d.
Fixed Deposits	323	8	9
Subscriptions	189	0	0
Fixed Deposit (Interest)	5	15	0
	£518	3	9

Expenditure.		£	s.	d.
Balance		37	9	0
Salary of Secretary		50	0	0
Ditto Attendant		6	0	0
Petty Cash		1	4	3
Printing, Stationery, and Periodicals		151	19	6
Interest due to Museum		15	8	9
Insurance		1	5	0
Cheque Book		0	8	4
Collector's Commission		7	10	0
Gas and Fuel		9	4	11
Legal Expenses		1	2	0
Balance per Bank Book	£29 13 0			
Cheque paid into Bank 14th Jan., 1889	1 1 0			
		28	12	0
Fixed Deposit		208	0	0
		£518	3	9

Examined and found correct.

JOHN MACFARLANE.
FRANCIS BUTLER.

11*th March*, 1891.

STATEMENT of the Funds of the MORTON ALLPORT MEMORIAL FUND *for the Year* 1890.

1890. Dr.	£	s.	d.	Cr.	£	s.	d.
Balance as per statement for 1890	50	5	9	Balance in Savings Bank to credit of Fund	68	1	4
Interest..	17	15	7				
	£68	1	4		£68	1	4

Examined with Savings Bank Book, and found to be correct.

JOHN MACFARLANE.
FRANCIS BUTLER.

11th *March*, 1891.

WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR

1890.

TASMANIA:
PRINTED AT "THE MERCURY" OFFICE, MACQUARIE ST., HOBART.

1891.

The Responsibility of the Statements and Opinions given in the following Papers and Discussions rests with the individual Authors; the Society as a body merely places them on record.

ROYAL SOCIETY OF TASMANIA.

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ROYAL SOCIETY.

APRIL, 1890.

The inaugural meeting of the members of this Society for the session of 1890 was held on April 22nd at the Museum. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., took the chair; and there was a large attendance of Fellows, while the visitors included a number of ladies.

PROFESSOR HUXLEY.

The President, on taking the chair, said he was not going to depart from his usual custom of only inflicting one address on the Society at the close of the session by giving an address also at the opening, but there was a matter which he would like to see brought before the Council and members of the Society. They had seen from the telegraphic news from London that Professor Huxley was on his way to Australia. He was to stop at Teneriffe and thence go on to the Cape, coming on to Australia by one of the Shaw Savill steamers. If that were so Hobart would be the first point in Australia that Professor Huxley would visit, and he thought that the advent of so great a man of science ought to receive some recognition from the Society. He therefore suggested to the Council and Fellows that it was very desirable that on his arrival the Professor should be met with an address from the Society. He would do all he could to induce Professor Huxley to break his journey at Hobart and spend a few days in Tasmania. But even if the Professor was only here during the short time the vessel was in Hobart he still thought they might make arrangements to invite him to the rooms of the Society to receive an address from the Fellows, which he (the President) would be glad to present. (Applause).

Mr. Alexander Durrand, F.R.M.S., was introduced as a visitor.

NEW FELLOWS.

Rev. E. H. T. Thompson, Messrs. A. W. Gosnell, M.A., and Robert Shirley Hales were admitted Fellows of the Society.

ADDITIONS TO LIBRARY.

The Secretary, Mr. A. Morton, read the following list of additions to the Library of the Royal Society :—

Adelaide University Calendar for the Academical Year 1890 (bound). From the Council.

Anales de la Oficina Meteorologica Argentina, Tomo VII. From the Department.

Anales del Ministerio de Fomento de la Republica Mexicana. From the Society.

Annales de la Société Royale Malacologique de Belgique. Current Nos. From the Society.

Annual Progress Report of the Geological Survey for the year 1888-9, Queensland. From the Government Geologist.

Anzeirger der Kaiserlichen Akademie der Wissenschaften Mathematisch Naturwissenschaftliche Classe XXV., 1888. From the Society.

Astronomische Arbeiten des K. K. Gradmessungs-Bureau, 1, Band. From the Society.

Athenæum. Current Nos.

Boletin Mensual del Observatoria Meteorologico del Colegio Pio de Villa. Colon Montevideo. From the Society.

Boletin Mensual, Tomo II., No. 34. Mexico. From the Society.

Boletim da Sociedade de Geographia de Lisboa. Current Nos. From the Society.

Bollettino della Societa Geografica Italiana, Serie 3, Vol. II., III., 1889, 1890. From the Society.

Bollettino dei Musei di Zoologia ed Anatomia Comparata, Vol. IV., 1889. From the Society.

Botany Bay, or Eucalyptus "Kino" (pamphlet). By J. H. Maiden, F.L.S. From the Author.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass., Vol. XVI., No. 6, Geological Series. The intrusive and extrusive Triassic trap sheets of the Connecticut Valley. By W. M. Davies and C. L. Whittle, Vol. XVIII., No. 5. The Morphology of the Cartoids. By F. Ayers, No. 6. Cave Animals from Western Missouri. By S. Garman. Annual Report for 1889. From Professor Agassiz.

Bulletin de la Société Imperiale des Naturalistes de Moscow, current Nos. From the Society.

Bulletin de la Société Royale de Botanique de Belgique Tome Vingt-Huiteme. Bruxelles, 1889.

Catalogue of Fossil Reptilia and Amphibia, part III., 1889. From the Trustees British Museum.

Contributions to Canadian Palæontology, Vol. I., by J. Whiteaves, F.G.S., "On some fossils from the Hamilton formation of Ontario, with a list of the species at present known from that formation and province." The fossils of the Triassic Rocks of British Columbia. On some Cretaceous Fossils from British Columbia, the N.W. Territory, and Manitoba. From the Department.

Department of Agriculture of Victoria, Bulletin June, 1888. Bulletin 3, 4, 5, April, July, and September, 1889. From the Department.

Department of Agriculture, Queensland—Report of the Government scientific expedition to Bellenden—Ker Range upon the Flora and Fauna of that part of the colony. From the Department.

Department of Mines, Sydney, N.S.W. Records of the Geological Survey of N.S.W., Vol. 1; Parts I., II., 111., 1889. Palæontology—No. 1. The invertebrate fauna of the Hawkesbury. Winamatta series, beds above the productive, coal measures of N.S.W. By R. Etheridge, junr. Mineral products of N.S.W. By Harrie Wood. Notes on the Geology of N.S.W. By C. S. Wilkinson. Description of the Seams of Coal worked in N.S.W. By J. Mackenzie. Geology of the Vegetable Creek Tin-Mining Field, New England District, N.S.W., with maps and sections. By T. W. E. David. Contribution to the Tertiary Flora of Australia. By Dr. C. Baron von Ettingshausen. Annual Report of the Department of Mines for the year 1888. From the Department.

Department of Agriculture United States (Division of Entomology). Insect Life. Vol. I., Nos. 1 to 12, 1889, devoted to the Economy and Life Habits of Insects, especially in their relations to agriculture, and edited by the Entomologist and sanction of the Commissioner of Agriculture. Nos. 1 to 6, 1889. Bulletin No. 16. The Entomological Writings of Dr. A. S. Packard. By S. Henshaw. 1887. Bulletin No. 18. The Life and Entomological Work of the late Townend Glover, first Entomologist to U.S. Dept. of Agriculture. By C. R. Dodge. 1887, Bulletin 19. An examination of the published synopsis catalogues and lists of N.A. insects, together with other information intended to assist the student of American Entomology, 1888. Bulletin 20. The Root Knot disease of the peach, orange, and other plants in Florida due to the work of Angullura, prepared under the direction of the Entomologist, J. C. Keal. Bulletin No. 9. The Mulberry Silkworm; being a manual of instructions in silk culture. By C. V. Riley. No. 10. Our Shade Trees and their insect defoliators; being a consideration of the four most injurious species which affect the trees of the capital, with means of destroying them. By C. V. Riley. No. 11. Reports of experiments with various insectide substances, chiefly upon insects affecting garden crops. No. 13. Reports of observations and experiments on the practical work of the division made under the direction of the Entomologist, 187. No 14. Do. do. No. 15. The Icerya or Fluted Scale, otherwise known as the Cottony Cushion Scale. Catalogue of the exhibit of Economic Entomology at the World's Industrial and Cotton Centennial Exhibition, New Orleans, 1884-5. No. 6. General Index and supplement to the nine reports on the insects of Missouri. By C. V. Riley, Washington, 1881. Third report of the U.S. Entomological Commission, relating to the Rocky Mountain Locust, the Western Cricket, the Army worm, Canker worm, the Hessian fly, together with descriptions of Larvæ of injurious forest insects. Studies on the embryological development of the locusts and of other insects, and on the systematic position of the orthoptera in relation to other order of insects. Four reports of the U.S. Entomological Commission; being a revised edition of Bulletin No. 3, and the final report on the Cotton worm, together with a chapter on the Bollworm. By C. V. Riley. Maps and Illustrations. From the Entomoogist.

Encyclopædia Britannica, a dictionary of arts, sciences, and general literature (ninth edition), Vols. 1 to 24, with index. From His Excellency Sir R. G. C. Hamilton, K.C.B.

Estudio de la Filosofia y Riqueza de la Lengua Mexicana par el preab AJastina de la Rosa. From the Department.

Geological and Natural History and Survey of Canada, A. R. C. Selwyn, LL.D., Director. Vol. I., pp. 11. Contributions to Canadian Palæontology. By J. F. Whiteaves, F.G.S. Contributions to the Micro Palæontology of the Cambria silurian rocks of Canada, pt. II. By E. O. Ulrich. From the Department.

Guide to the Mineral Gallery, British Museum. From the Trustees.

Guide to the study of insects and a treaty on those injurious and beneficial to crops, for the use of colleges, farms, and agriculturists, with 15 plates and 670 woodcuts. By A. S. Packard, New York, 1889, (Bound).

Hepatic, A new British. By A. H. Pearson. From the Author.

Illustrations of typical specimens of Lepidoptera, Heterocerca collection in the British Museum, Vol. VIII. By A. G. Butler. Illustrated (bound). From the Trustees.

Jahrbuch des Norwegischen Meteorologischen, Instituts, 1885-6. From the Department.

Journals and proceedings of the Royal Society of New South Wales, Vol. XXIII., 1889, report 1. From the Society.

Journal of Morphology, Vol. III. From the Editor.

Journal of the Royal Microscopical Society. Current Nos. From the Society.

Lichen Flora of Queensland with description of species. By J. Shirley. From the author.

List of named Insects in the South Australian Museum, Adelaide. By J. G. O. Tepper, F.L.S. From the author.

Meteorological Service, Dominion of Canada. Monthly weather Review. Current Nos. From the Department.

Meteorologische Beobachtungen Moscow. From the Department.

Monograph of the Horny Sponges of Australia. By Dr. Lendenfeld. Illustrated (bound). From the Trustees Sydney Museum.

Monthly notices of the Royal Astronomical Society (current numbers). From the Society.

Monthly Weather Review of the United States (current numbers). From the Department.

Monthly records of results of observations in Meteorological, Terrestrial Magnetism, etc., taken at Melbourne during October and March, 1889. From the Department.

Nature. Current Nos.

Nouveaux memoires de la Societe Imperiale des Naturalistes de Moscow, Tome XV. From the Society.

On Lighting and Gundpowder Magazine. On the Theory of Hail (pamphlets). From Mrs. Davies.

Perak Government Gazette. From the Government.

Proces-verbaux de la Seances Societe Royale Malacologique de Belgique. 1888-9. From the Society.

Proceedings of the Canadian Institute, Toronto, October, 1889. From the Society.

Prodromus of the Zoology of Victoria. Decade XIX. From the Government.

Psyche, a journal of Entomology, Comb., Mass. From the Society.

Proceedings of the Linnean Society of New South Wales (second series). Vol. IV. Pts. 1, 2, 3, 4. 1889. From the Society.

Records of the Australian Museum, edited by the Curator, Vol. I., No. 1, March, 1890. From the Department.

Records of the Geological Survey of India, Vol. XXII., pt. 4, 1889. From the Department.

Report of the first meeting of the Australasian Association for the Advancement of Science, held at New South Wales in August and September, 1888 (bound). From the Association.

Report of the Surgeon-General of the Army, U.S., June, 1889. From the Department.

Report of Mr. Tebutt's Observatory, N.S.W., for the year 1889. By J. Tebutt. From the Author.

Revue des Deus mondes, December 1, 1889. From the Society.

Revista do Observatorio Publico Mensal Imperial do Observatorio do Rio de Janciro, Amion IV., 1889. From the Society.

Scottish Geographical Magazine, current Nos. From the Society.

Societé de Géographie de Lisbonne L'Incident. Anglo-Portugais motion Votée a la Seance de la Sociète de Geographie de Lisbonne. Le 2 Decembre, 1889. Impotation abusive en Afrique par des subjets Anglais D'Armes Perfectionne. From the Society.

Statistics of the Colony of Tasmania for the year 1888. From the Government.

Transactions and Proceedings and Report of the Royal Society South Australia. Vol. XII., for 1888-9. From the Society.

Transactions of the Geological Society of Australasia. Vol. 1, IV. From the Society.

Transactions of the Royal Society of Canada for the year 1888. Vol. VI. From the Society.

Transactions of the Wagner'Free Institute of Science of Philadelphia. Vol. 2. From the Soceity.

United States Coast and Geodetic Survey Report of the Superintendent, showing the progress of the work during the fiscal year ending with June, 1887. Part I., Texts ; Part II., Sketches. From the Department.

Verhandlungen der Gesellschaft Fur Erdkunde [zu Berlin. Band XVI., XVII., No. 9. From the Society.

Victorian Year Book for 1888-9, Vol. I. From the Government Statist.

Victorian Naturalist, The. Current Nos. From the Society.

Walch's Catalogue of Books for 1890. From the Publishers.

SIR LAMBERT DOBSON thought that they could hardly allow the list of additions to pass without calling special attention to the valuable addition made to the library by the presentation of the ninth edition of the "Encyclopædia Britannica" by His Excellency. This was a very grand and noble work, a veritable storehouse of knowledge, and treating of almost every possible subject in articles supplied by the greatest specialists of the day. He would not move a formal vote of thanks, as His Excellency was in the chair, but he was sure he spoke the unanimous feeling of the Society when he said that they all cordially appreciated the gift of His Excellency. (Applause.)

HIS EXCELLENCY, who was received with applause, said that the discovery of the existence of a Royal Society in vigorous operation was one of the many pleasant surprises he met in coming to Tasmania, and he made up his mind to do all he could to advance its objects, and as time went on to mark his appreciation of the work of the Society in a tangible and useful way. He had himself found in considering some of the subjects brought forward by the Society the want of ready access to some comprehensive and authoritative work of reference, and it seemed to him that the want must be felt by others. He therefore determined to present the Society with the best and most comprehensive work of reference, and it gave him much gratification to find that the addition to the library had met with acceptance. (Applause.)

AUSTRALASIAN ASSOCIATION.

MR. JAMES BARNARD, Vice-President of the Society, said: Following the course which I took on the occasion of my return from attending the first meeting of the Australasian Association for the Advancement of Science, which was held in Sydney in 1888, when I gave a short personal explanation of what had occurred, I now ask permission to state in a few words the particulars of the second annual meeting of the Association, which was held in Melbourne in January last. As is known to the Fellows, several other gentlemen representing our Royal Society were associated with me in this visit to Melbourne, and I venture to in some measure speak their sentiments as well as my own when I bear testimony to the warmth and cordiality of the welcome accorded to us in Melbourne from the moment of our arrival until our departure. Throughout our stay we were most hospitably entertained with free quarters by Dr. Leeper at Trinity College in the University, besides sharing in a variety of entertainments and concerts given generally to the members of the Association by the distinguished President, Baron Von Müeller, K.C.B., the Hon. Sir William Clarke, Bart., the Worshipful the Mayor of Melbourne and others. Excursions and visits to places of attraction were also planned and provided for, and were more or less availed of. I need not speak of the part which my colleagues and myself took in the work of the several sections of the Association, as that will be shown in the annual volume recording its transactions. Suffice it to say that the sittings of the various sections were assiduously attended by our little Tasmanian band. During the session Tasmania came well to the front, and the proposal to hold the fourth annual meeting of the Association at Hobart in 1892, instead of at Adelaide, received general support, and was carried by acclamation. Hence it is suggested that a corresponding obligation is now imposed upon the Council and Fellows of the Royal Society of Tasmania, aided by the willing co-operation of all having sympathy with the object, to form themselves into a committee to consider the proper steps to be taken for holding the meeting of the Association in Hobart at the date fixed; nor is it much too soon to open a subscription-list and invite for it liberal support; for while it is neither expected nor desired that Tasmania, with its limited means, should attempt to vie with Melbourne or Sydney, with their magnificent resources, still the expenses incidental to the honour of the position, and the call to reciprocate in some degree the attentions shown to the Tasmanian representatives in the colonies mentioned, must necessarily be considerable. It may also be mentioned, in conclusion, as a good omen of success, that our painstaking and energetic secretary, Mr. Alexander Morton, has accepted the position of local honorary secretary for the occasion; and a general desire was expressed that our own highly-esteemed president, His Excellency Sir Robert Hamilton, would consent to officiate as president of the Association for its meeting in Hobart in 1892. (Applause).

THE SETTLEMENT OF NORTHERN TASMANIA.

Mr. J. B. **Walker** read a paper on "The Discovery and Occupation of Port Dalrymple." The writer began by remarking that the discovery of Southern Tasmania belonged to the ancient epoch of Australian history, but the discovery of Northern Tasmania to the modern period 150 years later, when Port Jackson had already been settled. The exploration of Bass Straits and of Port Dalrymple was the work of Bass and Flinders. A sketch of the daring voyage of Bass from Sydney to Western Port in an open boat, and of the discovery of Port Dalrymple and circumnavigation of Tasmania by Flinders and Bass in the little 25-ton sloop Norfolk in 1798, followed. The northern settlement was made by order of Lord Hobart, Secretary of State for the Colonies, for political reasons, to prevent the French getting a footing in Bass Straits. Colonel Paterson was appointed Lieut.-Governor of the New Settlement, and left Port Jackson on June 7, 1804, with 20 convicts and a guard of 20 soldiers. The ships were driven back by gales, but in October following a new attempt was made, and this time was successful. H.M.S. Buffalo, assisted by the schooners Integrity and Francis, and the armed tender Lady Nelson conveyed the expedition, which consisted of 67 military, under the command of Capt. Anthony Fenn Kemp and 74 convicts. Dr. Mountgarrett was surgeon, and Mr. Alex. Reilly storekeeper. The vessels were separated by a gale on the voyage down, and the Buffalo on entering the River Tamar ran aground near Outer Cove (George Town). The prisoners and stores were accordingly landed there on November 10, 1804, and formal possession was taken the next day. Huts were erected at Outer Cove, and the settlement established there, while Lieut. Governor Paterson went up the river to examine the country. He went up the North Esk some miles in his boat, and considered the country better than any that had been up to that time discovered, either in Van Diemen's Land or New South Wales. On his return, however, he chose, as his headquarters, a site at the head of the shallow inlet of Western Arm where the land was bad. Mr. Walker thought that Paterson's reasons for what seemed such an extraordinary choice were to be sought in the policy of the Home Government whose object was to establish military posts near the entrances of harbours to be maintained by convict labour, and not to found colonies in the modern sense. In March 1805, Paterson moved his headquarters to the new site, which he named York Town, but still retained the settlement at Outer Cove (George Town.) At this time the colony contained about 200 people, afterwards increased to 300. After about 12 months York Town was found so unsuitable that Paterson in March 1806, removed his headquarters to the banks of the North Esk, on the present site of Launceston. York Town was not finally abandoned until a year later. The site of this early settlement is about five miles north-west of Beaconsfield, at the head of Western Arm, nearly opposite to George Town. No remains exist of the buildings erected by Lieut-Governor Paterson in 1804.

A GANOID FISH.

The next paper, which was read by Mr. R. M. Johnston, was a description by that gentleman in conjunction with Mr. A. Morton, of a second ganoid fish from the lower mesozoic sandstones, near Tinder-Box Bay. Last session the same gentlemen brought under the notice of the Society a similar fish, obtained from the Knocklofty sandstones, and named *Acrolepis Hamiltoni*, in honour of the President, Sir Robert Hamilton. The present specimen is much better preserved, and although closely allied to the first is yet distinct in several respects. Some good photographs of the specimen were shown, and the writers expressed their belief that there was a probability of a larger number of these interesting fish remains being obtained when operations in certain quarries were again carried out. He mentioned as an interesting fact that a fish of similar species had been recently found at Latrobe.

MARINE ORGANISMS.

Mr. A. Durrand, Fellow of the Royal Microscopical Society, London, exhibited a select series of microscopical preparations of foraminifera and other minute marine organisms from soundings made at depths from five fathoms to about two miles among the islands of the Hawaiian Group, Coast of Java, Channel Islands (Guernsey), Ireland, etc., demonstrating the important part which the calcareous and siliceous remains of these organisms play in submarine deposits, which after upheaval and solidification, constitute a material portion of limestone and similar formations, the city of Richmond, United States, America, being built on an ancient sea bed covering a considerable area, many feet in depth, and largely composed of the inorganic remains of these tiny denizens of the deep, the beauty of which is indescribable by pen or pencil. Some of the specimens shown were from a fossil deposit over 60ft. thick at Wanganui, New Zealand, and appeared as perfect as those recently alive. In connection with this he stated that Mr. Morton, Secretary of the Society, and he (Mr. Durrand), purposed conducting dredging operations in the harbour to ascertain the distribution of these interesting forms, the result of which will probably be submitted to the Society during his stay, and as the microscopical life of our harbour may present some unique features, being yet comparatively unexplored, the investigations of Messrs. Morton and Durrand are expected to result in important information in this direction.

CONGRATULATORY.

The PRESIDENT moved a vote of thanks to the gentlemen who had contributed papers, and mentioned as a matter for congratulation that for the first time the printed proceedings of the past session were on the table at the opening of a new session.

The proceedings terminated.

MAY, 1890.

The monthly meeting of this Society was held at the Museum on Tuesday, May 20th, the President, His Excellency Sir Robert G. C. Hamilton, K.C.B., took the chair.

NEW MEMBERS.

The following gentlemen were elected Fellows :—Messrs. A. B. Howell, J. W. Beattie, Alfred T. Bell, and H. Foster.

THE LIBRARY.

The Secretary, Mr. A. MORTON, submitted the following list of additions to the Library during the month of April :—

Bollettino della Societa Geografica Italiana, Fasciolo II., February and March, 1890. From the Society.

Boletin Mensual del Observatorio, Meteorológico del Colegio Pio de Villa Colon. From the Department.

Boletin del Instituto Geografica Argentino, Tomo X Cuad X Bueno Aires. From the Society.

Flora of British India. Pt. XVI. By Sir J. D. Hooker. From the Department.

Geological and Natural History Survey of Canada, Alfred R. C. Selwyn, C.M.G., etc., Director. Annual Reports (new series). Vol. III., pt. I. Reports, A.B.C.D.E.F., 1887-8, pt. II. Reports, H.J.K.L.M.N.R.S.T., 1887-8. Maps, etc., to accompany Annual Reports, Vol. III., 1887-8. From the Department.

Handbook of cyclone storms in the Bay of Bengal, for the use of sailors. By J. Eliot, M.A. From the Meteorlogical Department.

Horsburgh's East India Pilot, containing a number of old Charts, London 1817, also Table des Cartes et Plans, contenus dans L'Atlas du voyage aux Terres Australis, 1801 to 1808. From the Hon. Attorney General.

Journal of the Royal Horticultural Society of London, Vol. XI., part III., October, 1888. From the Society.

Kongl. Svenska Velenskaps—Akademiens Handlingar Bandet 23, No. 3. Species Sargassorum Australiæ, Descriptœ et Dispositæ accedunt de Singulis Partibus. Sargassorum Earumque Differentüs Morphologicis in diversis speciebus observationes nonnullæ, nec non dispositionis specierum omnium generis his differentüs Fundatœ, Periculum, Auctore J. G. Agardh, cum XXXI., Tabulis. From the Society.

Memoirs of the Museum of Comparative Zoology, Cambridge, Mass. Vol. XVII. No. 1. The immature state of the Odonata. Pt. III. Sub-family Cordulina. By Louis Cabot. (Plates.) From A. Agassiz.

Memoirs of the Geological Survey of India, Palæontologica Indica, being figures and descriptions of the organic remains procured during the progress of the Geological Survey of India. Ser. XIII. Salt Range Fossils. Vol. IV., pt. I. Geological Results. By W. Waagen, Ph. D. From the Department.

Monthly Weather Review, Meteorological Service Dominion of Canada. (Current Nos.) From the Department.

Monthly Weather Review, U.S. War Department. (Current Nos.) From the Department.

Monthly notices of the Royal Astronomical Society, Vol. L., No. 4, February, 1890. From the Society.

Report on the worm disease affecting the oysters on the coast of N.S.W., by T. Whitelegge, F.R.M.S., April, 1890. From the Fisheries Department.

Revista do Observatorio Publicacao mensal de Observatorio do Rio de Janeiro, Anno V., Jan. de 1890, N. 1. From the Department.

Scottish Geographical Magazine, current Nos. From the Society.

United States Department of Agriculture (Division of Entomology), Vol. ii., Nos. 7, 8 and 9. Insect Life. January, February, March, 1890. Bulletin No. 21, Report of a trip to Australia, made under the direction of the Entomologist to investigate the natural enemies of the Fluted scale, by Albert Koebele. From the Department.

Victorian Year Book for 1888-89. From the Government Statist.

Tasmanian Official Record, 1889. By R. M. Johnston, F.R.S. From the author.

Transactions of the Royal Society of Victoria. Vol 1, Pt. ii. From the Society.

Transactions of the Seismological Society of Japan. Vol. xiv. From the Society.

THE LATE REV. J. E TENISON-WOODS.

Mr. R. M. JOHNSTON referred to a proposal to erect a memorial tombstone over the grave of the late Rev. J. E. Tenison-Woods, as a small tribute of respect to one who has done much for the good of religion and science, and also for the colonists generally, in whose interest he sacrificed his valuable life. He said he had been associated with the deceased for many years, and derived the greatest benefit from him in many branches of science. He was in sympathy with all fellow-workers throughout the Australias, and it was hoped the object would be successful. He placed a subscription list on the table in order that members who desired might contribute.

TASMANIAN FISHES.

Mr. R. M. JOHNSTON, F.L.S., read a paper, entitled, "Further observations upon the fishes and fishing industries of Tasmania, together with a revised list of indigenous species." Eight years ago he contributed a similar paper, and since that time Messrs. Alex. Morton and Saville Kent have added two or three interesting papers on the same subject. By this means the 188 species then known have increased to 214. After giving a complete list of the fishes Mr. Johnston dealt with the fishing industry, estimating that there are about 86 boats and 175 men engaged therein. Although it is estimated that, exclusive of the whaling trade, there are 1,005 persons directly depending upon the local fisheries, fully 63 per cent. of the men and boats belong to Hobart, and the men carry on their vocation either in the numerous sheltered indentations or bays in the upper or lower waters of the estuary of the Derwent, or in the exposed open sea between Seymour on the north-east and Port Davey on the south-west. The fishing carried on elsewhere, with the exception of the purely river fishing of the Tamar, is very limited, generally engaged in at odd times by persons who do not devote themselves exclusively to the fishing industry. The Tamar boats are not suited for fishing in the open sea of Bass Straits. With the exception of three or four decked smacks, the most of the boats employed in the waters of the Derwent, or in the open sea trumpeter and Barracouta fishing-grounds, are mere open centre-board whaleboats, fitted with fish-wells perforated in direct communication with the sea, and designed to keep the fish alive until sold in the open market in the Fisherman's Dock, Hobart (salt water.) The trumpeter and other fish will feed in such confinement, and the former has been known to live healthily in this way for a period of three months. The average value of one of these excellent sea-boats is (generally about 37ft. 6in. long; beam, 7ft. 8in.; depth, about 3ft.) about £100, and the equipment, in the shape of nets and deep sea lines, say £20; in all, say £120 for each boat. There are usually three men to each boat. Even with a small crew of this kind, as much as 40 dozen kingfish, weighing 12 to 14lb. each, have been caught in a single night when the fish have been plentiful. Barracouta can be captured in large quantities during the season—January to June. About 24 dozen Barracouta weigh a ton. The fishermen state that, could they be assured of a market, 3s. a dozen for barracouta or kingfish would amply repay them—*i.e.*, about ¼d. a pound. The average quantity of trumpeter, perch, trevally, barracouta, kingfish, conger eel, and crayfish, exported each year, almost wholly to Victoria, amounts to 3,396doz. The average price of the trumpeter is fixed at 1s. per lb., and he estimates that the yearly sales of fish since the decline of the oyster fishery do not exceed £10,000 per annum. The decline in the value of oil obtained from the whale fishery is shown by comparing the first and second quinquennium, the first yielding £31,281 worth, and the second £19,223 worth.

ROOT MATTERS IN SOCIAL AND ECONOMIC PROBLEMS.

Mr. R. M. JOHNSTON, F.L.S., continued his study of root matters in social and economic problems by reading a paper on that head. This contribution formed the second series, and follows the able paper read by him during last session. In that he dealt exhaustively with almost every branch of social and economic science, and in the paper read last night he treated the same subjects under the following heads:—"Natural Limits to the numbers engaged in various occupations;" "Dominating wants determine occupations, and necessarily produce inequalities in the form of services;" "Utopian scheme of socialists;" "What should be the probable effect upon social well-being if the major source of savings were destroyed;" "Anterior savings the true source of capital invested in the creation and distribution of necessary satisfactions;" "Fallacies of the single tax proposal." To give a clear example of the difficulties that are here to be met with by workers he introduces a fictitious deputation from the shoemakers driven out of employment by competition with cheap foreign manufactures, and employs a theorist to represent the Government and argue the question with him.

Mr. A. J. TAYLOR thought that one of the principal values of the papers read by Mr. Johnston consisted in the fact that they drew attention very positively to the fact that in writing and dilating upon the social problems occupying our attention we were apt to lose sight of the deeper considerations that underlie the superficial consideration often given to those questions. Mr. Johnston gave an illustration of this in his last paper, when in speaking of protection and freetrade, he called attention to the fact that we were apt, in dealing with the subject, to regard these important questions as ends rather than as means to an end, that end being to secure the maximum of comfort essential to living a healthy and happy life at a minimum cost of labour. He referred briefly to several of the subjects alluded to in the paper, and considered such contributions valuable, as showing the people that many economic questions have not yet been settled, and have still to be faced.

His EXCELLENCY said:—"A paper like that read to us to-night by Mr. Johnston requires to be studied carefully before discussing it, and I do not wish to enter into discussion with Mr. Johnston, for although some of the propositions he has raised are in their essence rather economic than political, yet the question of protection of native industries has, in these colonies, a political and party bearing which makes it undesirable that I, as Governor, should take part in discussing them. But there is one root matter in connection with economic problems bearing directly upon this point to which I do not think Mr. Johnston has sufficiently called attention, and it is this, that all commerce is barter, and that if we import foreign goods, either shoes or anything else, we export something in exchange for them, and if we cease to import such goods, we necessarily interfere with the production of the native goods which we exported to pay for them. I do not for a moment suppose that Mr. Johnston would dispute this root matter, and I am sure he will not feel annoyed at my pointing out that in my view it deserves more attention at his hands than it has received in this paper." He moved a vote of thanks to Mr. Johnston for his papers, which was passed.

HOP PLANT.

Mr. Alfred J. Taylor called attention to a specimen of the native hop (*Daviesa latifolia*). This shrub was to be found on all the stony ridges and barren bush lands of the colony. He had been assured that some remarkable cures of hydatids had been effected in Victoria by the administration of an infusion made from the leaves of this plant. Perhaps the Government Analyst would kindly prepare some notes on the plant for some future meeting of the Society. He also showed two interesting illustrations of homes made without hands in peculiar formations of gum leaves.

FORAMINIFERA AND MOLLUSCA.

Mr. Morton drew attention to a recent dredging trip in the harbour, and regretted that Mr. Durrand, who was introduced at the last meeting, was unable to be present to submit a microscopical slide containing some very interesting examples of various forms of foraminifera that he had mounted for the inspection of the Fellows. The result of the dredging trip was of importance, as the forms obtained resembled the marine fauna of Port Jackson, and the results of a few dredging trips intended during the season would no doubt prove very interesting. Among the specimens dredged were a large number of mussels, and each contained a small crab, which on examination appeared to belong to the genus Fabia. It was rather interesting to learn from some of the old residents that many years back, when mussels were numerous as at present, in the majority of cases every mussel contained a crab similar to those exhibited, and that the oysters, while mussels were in large quantities, were few. Some time afterwards the mussel became nearly extinct, while the oyster multiplied. Whether that was due to this parasitical crab or not he was unable to say, but the fact was singular that while the crab was now noticeable in the mussel the oyster was increasing in numbers. Whether history would repeat itself it would be difficult to say, but it would be interesting to observe the result. In conjunction with Mr. Durrand he intended at next meeting to submit a paper on the results of the dredging of the harbour.

Sir Lambert Dobson recollected that many years ago, when mussels were plentiful, they were destroyed by a little red crab. For many years there were no mussels, now they were again plentiful.

Mr. R. M. Johnston said he had noticed as a remarkable coincidence that the disappearance of the mussel in former years was followed by the increase of the oyster, and the decrease of the oyster meant the increase of the mussel. It was desirable to know the cause of this phenomenon, and he hoped Mr. Morton would pursue his investigations in regard to those molluscs and their enemies.

Mr. Morton said that he had had forwarded to him, by the Fisheries Commission of New South Wales, a most valuable paper prepared by Mr. Thos. Whitelegge, F.R.M.S., Zoologist to the Sydney Museum, on the disease observed in the oysters on the New South Wales coast. As the question of introducing the Sydney oyster on the Tasmanian coast occupied the attention of the Fisheries Board at present, he intended to submit some extracts from Mr. Whitelegge's valuable paper at next meeting of the Society.

The President moved a vote of thanks to Mr. Johnston for his valuable papers.

The proceedings then terminated.

JUNE, 1890.

The monthly meeting of the Royal Society was held on Wednesday, June 11th, at the Museum. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., took the chair.

NEW MEMBER.

Mr. M. W. Simmons, solicitor, was elected a Fellow of the Society.

RECORDS OF EARLY EVENTS.

Mr. **MORTON** read a letter from Mr. A. B. Biggs, Launceston, suggesting that something be done by the Society in collecting records of early events in the history of the colony from the few surviving old colonists, as they were rapidly passing to the majority, and the opportunity would soon be for ever lost. The letter was referred to the consideration of Mr. J. B. Walker, who is interesting himself in the ancient history of the colony.

AUSTRALASIAN SCIENCE ASSOCIATION.

Mr. **MORTON** submitted programme of the third annual meeting of the Australasian Association for the Advancement of Science, which will commence on Thursday, January 15, 1891, at Christchurch, New Zealand.

His **EXCELLENCY** asked if any of the members of the Society were going take to part in the proceedings.

Mr. **MORTON** said he believed that several members had forwarded their names to New Zealand.

THE MOON AND THE RAINFALL.

Mr. E. C. **NOWELL**, hon. member Royal Statistical Society, read a paper entitled "Do the changes of the moon affect the rainfall?" He said that the idea that the changes of the moon affected the rainfall had widely prevailed from the earliest ages. Traces of it were found in the Roman poet Virgil, while ages before the Babylonian Government Astronomers in their daily reports inserted many entries respecting the supposed influence of the heavenly bodies on the weather. Sailors especially were great believers in the influence of the moon on the weather, and the writer believed that it would be found that where ideas have become deeply rooted and widely spread, it is very seldom, if ever, that they have not some foundation in fact. The public, however, were assured by those whose opinions on such subjects carry great weight, that the popular notion was a mere delusion, and that the moon's changes had no influence on the weather. He quoted as scientific authorities on this point, Dr. R. J. Mann, vice-president of the Meteorological Society, Dr. Lardner, and Dr. Ball, Royal Astronomer of Ireland. Seeing that the statements of scientific men were at variance with the popular opinion, he resolved to investigate the matter for himself, and accordingly in 1880 he commenced to keep a meteorological journal in a rough way, and had continued it up to the present time. The results of the 10 years' observations were set forth in tabulated form, and so far as the inquiries on the subject warranted a conclusion, the only thing that could with safety be asserted was, "That there is a greater probability of having rain on the first than on any succeeding day of any of the moon's changes. He hoped the results submitted would be of some value as a contribution towards the investigation of an obscure but highly interesting subject, and also in stimulating further researches in this direction, in order to discover, if possible, what are the exact nature and limits of the influence exerted upon the earth and its inhabitants by the moon and the remoter planets—the lesser forces—as well as by the great central source of power—the sun itself.

Captain **Shortt** read a brief paper, criticising Mr. Nowell's views, in which he contended that it was not to the moon's influence alone that they should look for the effect stated, although he admitted that the moon was a great factor in the case. Though all parts of the world were not affected alike by the aspect of the sun, moon, and planets, he found that at Hobart under Jupiter and Mars' influence the temperature increased, and decreased with Saturn's; likewise the aspect of Saturn, Uranus, Venus, and Mercury produced rain and low temperature; also, that the aspect of the different planets produced more or less changes in the weather. It was also noticeable that after the tide turned to rise rain set in or fell heavier in rainy weather. Mr. Nowell, in his paper, had only notified the commencement of rain, and did not give the number of rainy days in each quarter. He submitted a calculation of rainy days for 1889, omitting those under three points, which showed that the greatest number of rainy days was on the fourth or middle day of the quarter. The results were set out in tabulated form, and showed that there were 61 days of one or two points of rain. This large number of rainfall he considered attributable to the proximity of the city to Mount Wellington, which attracted the low moist clouds, from which fell slight showers of rain.

Mr. C. H. **Grant** thought it would be interesting to the Society and science generally if Capt. Shortt would give some detailed particulars of the way in which he arrived at the conclusions he had stated in regard to the planets affecting the weather, as those conclusions were not generally known or accepted. He would like also to remark, in regard to Mr. Nowell's paper, that the writer did not profess to be a scientist, and therefore his conclusions were not to be judged by the rigid rules of science. It seemed to him that he had amalgamated to a certain extent popular ideas with science, and that therefore all his conclusions must not be accepted as absolutely proved truths. In regard to lunatics for example, science had proved that there was not that affinity of the one with the other that he had indicated. They were indebted to Mr. Nowell for the trouble he had taken, and he hoped it would lead to the changes in the weather being more carefully noted. The near proximity of the city to Mount Wellington, he believed, affected the rainfall, and consequently he thought that the meteorological tables of Hobart could be said to have very little value as compared with parts of the colony less affected by the proximity of the Mountain.

Capt. **Shortt** promised to read a paper on the influence of the planets on the weather before the end of the session. (Hear, hear.)

Mr. **Nowell**, in reply, said it was impossible for him to deal fully with Captain Shortt's criticisms without having an opportunity to peruse his paper, but if the paper read had done nothing else, it had brought out a most interesting statement from Captain Shortt, and the promise of an interesting paper. Captain Shortt had conducted his observations on a different system, but until he had a further opportunity of studying the matter he must adhere to his own system. Mr. Grant was inclined to think that the influence of the moon on lunatics was one of the popular ideas, but he thought it had been pretty well established by the officers of lunatic establishments, and might now be regarded not as one of the popular ideas, but as a scientific fact. Of course, as Mr. Grant said, he did not profess to be a scientist, but had rather treated the subject from a statistical point of view. They did not profess to be ultimate conclusions, but merely such as the facts seemed to warrant, and he would be glad if his paper was the means of causing the matter to be more accurately investigated. In regard to the situation of Hobart and its proximity to the Mountain, he had guarded himself on this point by explaining that the observations were only intended to apply to Hobart, but he might say that Mr. Shoobridge told him that the rainfall at New Norfolk differed but slightly from that of Hobart, and suggested that he (Mr. Nowell) should take his observations. He considered, however, that he had better confine himself to Hobart, but never for an instant suggested that the conclusions derived from observations at Hobart would be generally applicable throughout the colony.

A FOSSIL TREE.

Mr. **James Barnard** read the following notes on a fossil tree found beneath 100ft. of basalt, at Richmond, Victoria, by S. H Wintle:—"In the early part of March last I received information to the effect that a fossil tree, 30ft. in length, had been brought to light by the workmen employed in the "bluestone" quarry of Messrs. Willis Brothers, at Richmond, Victoria. I immediately visited the spot, and found the bole of a tree lying in an east and west direction, partly embedded in a deposit of dark coloured sand. Portions of the trunk were in contact with the base of a basaltic flow 100ft. in thickness by measurement. The general opinion, before I examined it, among the uninitiated connected with the quarry, was that it was the common red gum of Victoria, *Eucalyptus rostrata*. I at once recognised it as belonging to an entirely different order, and if not a pine not very widely removed from it. Up to the present time, however, it has not been determined. I may, perhaps, venture to observe that in it I can see a close resemblance to *Salisburia* sp. (Mueller), which in several instances has been brought to light from under the basalt of the "deep leads" of Ballarat and elsewhere in Victoria. The tree is denuded of its branches; short stumps alone being left. This fact, coupled with the absence of twigs, leaf impressions, and seed vessels, and also the fine uniform character of the sand deposit, points to the tree having been carried to where it was found by aqueous drift agency. Although I requested the proprietors of the quarry to instruct their workmen to preserve anything in the vicinity of the tree which in the least might resemble nuts or cones, nothing in the shape of fossil fruit has been brought to light. I have been promised, however, that efforts will be made to disentomb the whole tree. The cracks and fissures of the ligneous tree are coated with minute iron pyrites; while the sand on which the tree immediately reposes is cemented to a considerable extent by the presence of the same mineral. For a depth of 4ft. from the base of the superimposed basalt, the deposit on which the tree rests may be described as an imperfect dirt bed, being charged with carbonaceous matter in a fine state of division. A well has been sunk in the compacted sand to a depth of several feet in order to catch the drainage from the joints and fissures in the basalt, but no rounded pebbles or gravel have been met with; nothing, in short, but fine drift sand, thus pointing to a depression that was filled up to a considerable extent by sand transported by aqueous agency prior to the outburst and overflow of the basaltic lava. The southern wall of the quarry is only 50yds., lineally, from the Yarra River. On the opposite bank the highly inclined Upper Silurian shales obtain, forming a precipitous bank in contradiction to a more or less gradually shelving bank wherever the basalt obtains. As the source of this newer pleistocene basalt had its origin, it is generally believed, at Heidelberg, some 10 miles distant, there is good ground for assuming that the Yarra River had not an existence at the period when the basaltic flow formed a crypt to the tree and sand bed; but that at a subsequent epoch it carved out its present channel, chiefly along the line formed by the contact of the basalt with the Silurian strata. It will be observed that the condition of the wood is that of more recent lignite, the fibres being very tough. I am strongly reminded by the occurrence of this tree beneath the basalt, and the physical change which has taken place since it was deposited on its sandy bed, as well as by the existence of the Yarra River, of a similar change at a similar period at the site of the Geilston Bay freshwater limestone at Richmond, in Tasmania. A quarter of a century ago I published a popular description, under the title of "A Story of a Stone," of the great geological changes which had taken place since the traverting beds had been laid down by the eruption of basalt, and the subsequent formation of the River Derwent. The relation that the Yarra River bears to the fossil tree, its sand bed, and superimposed basaltic covering, is precisely the same as that which the Derwent River bears to the fossiliferous travertine deposits." Mr. **Barnard** added that similar specimens had been presented to the Tasmanian Museum by his son, Dr. Barnard, while in New South Wales.

Mr. **Morton** expressed regret at the absence of Mr. R. M. Johnston, owing to indisposition, as that gentleman was well acquainted with the subject, having largely referred to it in his "Geology of Tasmania."

Mr. C. H. **Grant** said that the grain of the wood and general appearance of the specimens showed that the dioritic formation that poured out upon the trunk of the tree was at a lower temperature than was generally supposed.

SPECIMENS.

Mr. T. B. **Moore** exhibited specimens of Eucalyptus, a variety of Risdoni, and a garnet stone from Collingwood Valley, West Coast.

Mr. **Morton** exhibited two parrots, presented by Mr. F. Back, General Manager of the Government Railways. They are the Kea (*Nestor notabilis*), natives of New Zealand, and very destructive to sheep.

Mr. **Curzon Allport** exhibited a specimen of black marble, taken from the mouth of the Gordon River, West Coast. Samples had been sent to London, and a company formed to work the same.

Mr. **Morton** submitted specimens of ferns connected with limestone formations taken from the Chudleigh Caves.

On the motion of His **Excellency**, votes of thanks were passed to the gentlemen who contributed papers.

The proceedings terminated.

JULY, 1890.

The monthly meeting of the Royal Society was held at the Museum on Monday evening, July 14th. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., presided.

NEW MEMBER.

Mr. Alexander Montgomery was elected a Fellow.

LIST OF ADDITIONS TO THE LIBRARY.

The following list of additions to the Royal Society's Library during the month of June were read :—

Acta Horti Petropolitani Tomus XI. Fascinlus 1.—From the Society.

Annual Report of the Department of Mines, New South Wales, for the year 1889.—From the Department.

Archives du Musée Teyler, Serie II., Vol. II., 1886; Vol. III., 1887; Serie II., Vol. III., 1889.—From the Department.

Boletin Mensual del Observatorio Meteorologico del Colegio Pie de Villa Colon, Montevideo. From the Society.

Bollettino della Societa Geografica Italiana. Serie III., Vol. III. Fasc. III. Mazo, 1890. From the Society.

Boletino del Instituto Geografico Argentino. Tomo X., Cuarderno X., XI., XII., Buenos Ayres. From the Society.

Boletino Mensual, Tomo II., No. 5, Mexico. From the Department.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A. Vol. XVI., No. 7. The Topography of Florida, by N. S. Shaler. No 8. On some occurrences of Ottrelite and Ilmenite Schist in New England, by J. E. Wolff. Vol. XIX., No. 1. Studies on Lepidosteus, part I., by E. L. Mark. No. 2. On the egg membranes and Micropyle of some Osseous fishes, by C. H. Eigenmann. No. 3. Reports on the results of dredging under the supervision of Alexander Agassiz in the Gulf of Mexico, 1877-3, etc. XXXII. Report on the Nudibranchs, by Rud. Bergh. From the Department.

Californian State Mining Bureau, Ninth Annual Report of the State Mineralogist for the year ending December 1, 1889.—From the Department.

Cyclone Memoirs Part II, Bay of Bengal Cyclone of August 21, 28, 1888.—From the Department.

Fondati on Teyler, Catalogue de la Bibliothéque, dressé par C. Ekama, Cinquieme, Livraison, Paleontologie, Geologie, Mineralogic Botanique, Zoologie, Géographiè, Costumes, Voyages pittoresques et Scientifiques.—From the Department.

Journal of the Royal Microscopical Society. Part 2, 1890. From the Society.

Los Agnas Minerales de Chile por el. Dr. L. Darapsky, Valparaiso. From the Society.

Monthly Record of Meteorological Observations for Victoria. From the Department.

Monthly Weather Review, Canada (current Nos.). From the Department.

Monthly Notices of the Royal Astronomical Society (current Nos.) From the Society.

Observatorio Nacioaal Argentino, vol. XI. Buenos Ayres. From the Department.

Perak *Government Gazette* (current Nos.) From the Government Secretary.

Proceedings of the Yorkshire Geological and Polytechnic Society (new series), vol. XI., part II., 1890. From the Society.

Scottish Geographical Magazine (Current Nos.) From the Society.

Synopsis of the Queensland Flora, containing both the Phænogamous and Cryptogamous Plants. By F. M. Bailey, F.L.S. From the Department.

Transactions of the Royal Geographical Society of Australasia (Victorian Branch). Pt. II. Vol. XII. From the Society.

Transactions and Proceedings of the New Zealand Institute, 1889. Vol. XXII. From Society.

Report, twenty-sixth annual, of the Zoological and Acclimatisation Society of Victoria for the year, 1889. From the Society.

Report, Sydney Free Public Library, for 1889-90. From the Trustees.

Report of the Wellington Acclimatisation Society, for nineteen months ending March 31, 1890. From the Society.

Revista do Observatorio, No. 4. Rio de Janeiro. From the Department.

Ver handlunger der Gesellschaft. Für Erdkunde Zu Berlin. Current Nos. From the Society.

Victorian Naturalist. Vol. VII., No. 1. May, 1890. From the Society.

NATIVE STONE IMPLEMENTS.

Mr. MORTON read a letter which His Excellency had received from Mr. S. S. Rice, London, stating that his friend, Mr. E. B. Tyler, of the University Museum, Oxford, was anxious to procure some of the native stone implements of Tasmania, and asking His Excellency to assist in the matter.

Mr. MORTON stated, in reply to His Excellency, that there was a collection of such stones in the Museum, and also a number in duplicate. Several of the Trustees of the Museum were present, and no doubt the matter would receive consideration at their next meeting.

His EXCELLENCY said that the writer had a great deal to do with the University Museum at Oxford, having evidently made the subject a study. He thought it would be well to send the specimens, if that could be done without denuding our collection.

Mr. C. T. BELSTEAD said he was sure that the matter would receive full consideration from the Museum Trustees.

DREDGING TRIP ON THE DERWENT.

Mr. A. MORTON read some "Notes on a recent dredging trip in the Derwent." He said: "The Tasmanian Fisheries Commissioners having decided to examine the several bays in the River Derwent for the purpose of ascertaining whether as in former times there still existed natural oyster beds, advantage was taken of the opportunity to pay special attention to the marine fauna that might be obtained by means of the dredge. Mr. A. Durrand, F.R.M.S., at present on a visit to Tasmania, who has made a collection of foraminifera from many parts of the Southern seas, accompanied us on our trip. Several bays to the northward of the harbour were tried, but the dredge failed to secure any specimens of oysters, and in only one or two instances did we obtain any dead shells. Although from a commercial point of view the result of the dredging trip proved comparatively a failure, still from a scientific point we were amply rewarded. Instead of finding the oyster a large quantity of pectens or scallops were obtained. As had been pointed out by the Secretary to the Fisheries Commission (Mr. Seager), a large number of this shellfish can be obtained in the River Derwent by means of dredging, and the quality being equal to the European scallops it is to be hoped that steps will be taken by our fishermen to place in the market this class of shellfish, which would readily find consumers. As the places dredged in were rather far up the river the number of species of mollusca was naturally limited. Several crustaceans, chiefly of the smaller kind, were obtained, one kind being found in great numbers inhabiting the common mussel. This curious little crab has a wide range common to the European seas, but, although found inhabiting the mussel of New Zealand, has not been observed in the mussel found round the New South Wales coast. A large number of species of a delicate Echin were met with, a species which is found to have a very wide range, having been obtained on the N.E and North coasts of Australia, Japan, S.E. Coasts of New Guinea, East Indies, Cape of Good Hope, New Zealand, and New Caledonia. Some five or six species of sponges were obtained, samples of which he intended to have forwarded to Mr. Arthur Dendy of Melbourne University for identification, as that gentleman is at present paying considerable attention to the spongidiæ of Australia. Several specimens of foraminifera were obtained. In concluding, he said that from the large number of specimens obtained during the trip, and considering the very primitive and unsuitable dredge in use, he was convinced that a most interesting and valuable collection of marine fauna might be obtained in the Derwent, and accordingly decided during the summer months to carry out a similar system of dredging to that which he was engaged in for the Sydney Museum on the Queensland coast and at Port Jackson during the years 1879, 1881-2. (Hear, hear.)

TASMANIAN MOLLUSCA.

Mr. A. MORTON (for Mr. R. M. Johnston, F.L S.), read a paper on "Provisional aid to the study of the Tasmanian Mollusca." The writer remarked that the student of conchology in Tasmania laboured under a disadvantage in that the description of the various species inhabiting our waters was scattered widely in various publications of Europe and America, while nearly half the number of the principal type species are deposited in foreign museums and are therefore inaccessible for purposes of reference to local students. Much careful work required to be done before we could rest satisfied with existing classification of species, for it was well-known that the specific descriptions of the earlier distinguished collectors who accompanied expeditions to our seas were often too meagre to satisfactorily distinguish or separate them from many allied distinct species subsequently discovered. He suggested that the example of New Zealand should be followed in making up a duplicate collection of our shells as complete as possible, and thereafter submit them to a well-known European authority like Ed. Von Martins, who could critically examine and compare them with original types in European collections, and submit a report for guidance of local workers. If Messrs. Legrand, Petterd, and Beddome, who have so ably worked in this branch of science in Tasmania, and who possess the best local collections, were to engage in a work of this kind under the auspices of the Royal Society of Tasmania, he was satisfied that the very best results would be attained, and we would then prepare the way for the publication of a work on Tasmanian Mollusca upon which thorough dependence could be placed. He alluded also to the labours of the Rev. J. T. Tenison Woods, F.L.S., and the Rev. H. D. Atkinson, of Circular Head, in connection with this study. He gave a comprehensive account of the bibliograpy of the subject, and for the convenience of local students who are not in possession of works of reference, he added a part devoted to the description of the various families, mainly based upon the late G. W. Tryon's splendid work on

"Structural and Systematic Conchology" (April, 1884). To afford additional facilities to such students he prepared an artificial key to the classes, family, and genera, which he hoped would prove to be of service.

Mr. A. J. TAYLOR expressed regret at the absence of Mr. Johnston through indisposition. Mr. Johnston's writings were not only invaluable in themselves, but specially so as they were generally written with a view to meet the requirements of young students.

THE DOUBLE COCOANUT.

Mr. ALFRED J. TAYLOR read a paper on the *coco-de-mer* (*Lodoicea Seychellarum*) or double cocoanut, which had become interesting of late owing to some misleading paragraphs which had found their way into the English Press regarding it.

AUGUST, 1890.

The monthly meeting of this Society was held on Monday, August 12th. The President, His Excellency Sir R. G. C. Hamilton, took the chair.

NEW MEMBERS.

Mr. Thos. Whitelegge, F.L.S., Zoologist Australian Museum, was elected a corresponding member, and Mr. F. Chalk, barrister-at-law, a new member.

A FOSSIL TREE.

Mr. James Barnard read a communication which he had received from Mr. S. H. Wintle in regard to a paper read by Mr. Barnard for him at the June meeting of this year, entitled "Notes on a Fossil Tree found beneath 100ft. of basalt at Richmond, Victoria." Mr. Wintle wrote as follows :—

"I find in the discussion which followed the reading of my remarks by the Vice-President, that Mr. C. H. Grant expressed an opinion that the condition of the wood afforded satisfactory evidence that the basaltic lava which entombed it could not have had a high temperature. A moment's reflection will show that such a conclusion is quite untenable. The degree of heat necessary for molten rock-matter, such as lava, to flow, is laid down by no less an authority on Seismology than Mallet to be from 1,900deg. to 2,000 deg. Fahr., a temperature sufficient to melt copper. Mr. Grant's opinion as to a low temperature of the basalt at the time it overflowed the tree was based, I presume, upon the fact that the wood displays no sign of being carbonised, or charred, beyond a slight trace at its superior surface at the point of contact with the once molten rock. This feature, I take it, is to be accounted for by the fact that the enveloping fluid lava by excluding the air would effectually prevent an access of oxygen to the wood ; and further, that the surface of the lava-stream, which would come in contact with the tree first, is always cooler than the interior or the base of the stream. I also observe that Mr. Grant regards the basalt (a specimen of which accompanied the example of the fossil wood) as 'diorite,' according to the report referred to. With all due deference I would observe that this is erroneous. It is true basaltic lava of that kind known as Anamesite of Pleistocene Age, and not greenstone, which diorite proper is. The newer basalts, which in Victoria have filled up so extensively Miocene and Pliocene valleys, and river channels, are chiefly vesicular zeolitic *dolerites* and *Anamesites*, the former being well represented by the light coloured Malmsbury 'bluestone' so extensively employed in buildings in Melbourne."

Mr. Grant explained that he had only referred to the matter as a suppositious case, and that his remarks had been evidently misunderstood.

Mr. R. M. Johnston said he was not present when the paper was read, but he thought he knew something of the constitution of this fossil. In his work on Geology a section of the book was taken up in describing such fossil trees. From the description given he imagined that this fossil exactly corresponded with those found in the deep leads of Beaconsfield. From the appearance of those fossils it was quite possible that the wood was protected at one time by clay, which formed a protective envelope between it and the overflow of the basalt. The best specimens could be obtained in the railway cuttings at Breadalbane, where a perfect forest of the ancient vegetation of the Mesozoic period was entombed, and destroyed by the scoria and ashes and molten flows of matter from the volcanic eruptions at that time so prevalent in this and some other localities throughout Tasmania. It has been found by mineralogists that if basalt is thrown up by eruptive influence in a state of ashes, and if afterwards chemical action takes place, it sometimes becomes perfectly crystalline, and as if it had been originally in a state of liquefaction. At Breadalbane they were seen in every possible stage. In no country in the world, so far as he was aware, was there exhibited the remains of this vegetation in such abundance in every stage as was to be found in Tasmania.

Mr. ALFRED J. TAYLOR said that judging from the remarks recently made by Baron Nordenskiold before the Royal Swedish Society of Arts, it was possible that the wood referred to might have been covered by basalt without being charred. The Baron's remarks were as follows:—"The members of the Academy are aware of the fact that on several occasions I have given reasons which tell against the supposition that the layers of basalt have been formed through eruptions of glowing melted lava. Once in Greenland I saw a phenomenon which, if it had been fully investigated, would have beem of great assistance in the solving of this question. Namely, I once met with a thick '*moja*' stream, which was slowly rolling down a steep headland on the north-eastern coast of the Nuorsoak Peninsula, and which seemed to come direct from the basalt mountains. I had great difficulty in crossing this stream, which consisted of a sticky substance. Only after returning home my attention was called to the fact that this substance when hard might probably form the basaltic layers." From these remarks it would be seen that the problem referring to the formation of basalt had not been successfully settled, and that it was quite possible for Mr. Wintle to have been perfectly right in the conclusions he had arrived at with regard to the piece of wood under discussion.

Rev. J. B. W. WOOLLNOUGH said that when he was in Iceland, where there was only one living tree, he not unfrequently came across partially burned wood which had been exposed to great heat and overflows of lava, which had been protected evidently by some surrounding substance which had hindered the lava from influencing it as otherwise it would have done. In some cases the wood was only slightly charred, and it seemed to have lost almost completely its weight. When a piece was taken up in the hand it seemed as if all the weight had been pressed out of it. One piece of wood to his knowledge had been under a very thick piece of lava.

ANTARCTIC EXPLORATION.

The following correspondence from the Hon. Secretary (Mr. A. C. Macdonald) of the Royal Geographical Society of Australasia, was read by the Secretary (Mr. A. Morton):—

"Royal Geographical Society of Australasia,
"Society Rooms,
"Collins-street W.,
"Melbourne, July 30, 1890.

"DEAR SIR,—I am directed by the Antarctic Committee to inform you that at a meeting of the committee held at the Melbourne Observatory on the morning of Tuesday, the 29th July inst., the following resolutions were passed:—

1. "The Antarctic Committee learn with pleasure the magnificent offer of Baron Oscar Dickson to defray one half the cost of an expedition to explore the Antarctic region, provided that the other half, not exceeding £5,000, be contributed by the Australasian colonies, Baron Nordenskiold to take command of the expedition. This committee cordially desires to accept the offer, and hereby resolves to appeal to the general public throughout the Australasian colonies for subscriptions towards the movement.

2. "That a copy of the foregoing resolutions be forwarded to the Royal Societies of Queensland, New South Wales, Tasmania, and Queensland branches of the Royal Geographical Society of Australasia, soliciting their co-operation.

"The Consul-General for Sweden and Norway, who was present at the meeting, kindly promised to communicate with Barons Nordenskiöld and Dickson, and to transmit copies of the report of the meeting. A committee was formed to prepare resolutions to be submitted at a public meeting to be held during the month of August. Arrangements will be made for delivering one or more public lectures. Already several handsome subscriptions (two of £100 each) have been promised, and the committee feel satisfied that if a reasonable effort is made the required amount will easily be raised.

"In conclusion, the committee respectfully request your cordial co-operation in a movement which is essentially Australian and National, and which should certainly result in the acquisition of knowledge to the world, and the prospective possibilities of profitable investment.

"A. C. MACDONALD,
"Hon. Sec. and Treasurer.

"The Secretary,
"Royal Society of Tasmania."

[Telegram.] "Melbourne, July, 31, 1890.
"The Secretary, Royal Society of Tasmania, Hobart.

"At a meeting of the Australian Antarctic Committee held 29th inst., Baron Oscar Dickson's munificent offer to defray half the cost of an expedition under the command of Baron Nordenskiöld, to explore the Antarctic regions, conditionally that the Australian colonies subscribe the other half not exceeding £5,000, the offer was cordially accepted, and it was unanimously resolved to appeal to the general public alone (not to Government) for subscriptions in aid of the object. Two members of the Royal Geographical Society of Australasia (Messrs. J. S. Gotch and Professor Kernot), subscribed £100 each, and several other sums have also been promised. Public meetings and lectures are being arranged. His Excellency the Earl of Hopetoun will preside at the inaugural lecture to be held early in August. The Consul-General for Sweden has undertaken to communicate with Barons Dickson and Nordenskiöld. The Antarctic Committee respectfully requests your co-operation, and suggests the formation of an Antarctic Committee composed of members of your Society and other leading commercial gentlemen in Hobart. Letters embodying resolutions passed here on 29th inst. and form of subscription list by post.

"A. C. MACDONALD,
"Hon. Sec. and Treasurer, R.G.S. of Aust."

His EXCELLENCY said: It seems to me that the objects to be gained by Antarctic exploration are so numerous and important, that it seems to be strange that it should have been so long delayed. When we consider that we know almost nothing practically of these regions, that a chart has yet to be made of them, showing which points and coast lines are land and which are merely floating ice, and that the geology, botany, and natural history of this great region are all at present a blank, I cannot conceive of any more worthy field for the explorer from a scientific point of view. Moreover, until we know something of this immense area, we must remain in ignorance of the laws which govern the climates of the globe, and more particularly of the vast continent of Australia. Then again, to us in Tasmania, the nearest of the Australian colonies to these regions, the commercial aspects of the exploration may prove important, for it is quite conceivable that it might lead to a revival of the great whaling industry which was once a staple industry of Tasmania. One feels a certain amount of regret that this exploration should not have been undertaken under the British flag, seeing that the interests of the British Empire in it are certainly greater than those of any other country, but when such a noble offer has been made as that of Baron Dickson, and the opportunity arises of having the expedition under a man like Baron Nordenskiold, I think the least we can do here in Australia is to enter heart and soul into the project, and assist it to the best of our ability. I observe that in Victoria it is proposed to raise the funds necessary by private subscriptions, and not by a grant from Parliament. So long as the money is forthcoming it does not much matter how it is collected, but on this point it would be desirable to ascertain what the views of the members of this Society are. We did all we could to push forward the last proposed expedition, which fell through unfortunately, and I feel sure that now this Society will do all it can to further the present one. I judge from the very moderate sum of £10,000, which is its estimated cost, that it can only be a preliminary and experimental one, but I have no doubt that if it brings back important information, as no doubt it will, that further expeditions will in future be undertaken to set at rest the many scientific questions which are at present locked up in this great unexplored region.

BISHOP MONTGOMERY said that before he left London he had expressed the hope that he might yet have the South Pole in his diocese. (Laughter.) This expedition was important not only from a commercial point of view, but also because it was desirable to gain a clear knowledge. We were necessarily called upon to ascertain all about our own Hemisphere, of which Tasmania might hope one day to be mistress.

Mr. JAMES BARNARD alluded to the previous movement in favour of this object when a committee was formed in 1886. He surmised from a communication he had received that that committee was now merged in or superseded by the present movement. He also considered it a matter of regret that England had not taken part in the expedition, but inasmuch as science knew no nationality, it was, from a scientific point of view, a matter of indifference whether England took her share or did not do so. With regard to subscriptions, he thought that the Government should be approached to contribute the colony's share. It seemed to him that from an expedition of this description there was no individual benefit to be derived, the benefit would be a national one, and looking upon the matter in this light he considered that the Government should be approached to give the approximate share justly due by Tasmania as a colony largely interested in the expedition.

Sir LAMBERT DOBSON said it seemed to him that this must be a question of interest to everyone who had any regard for science. The world had now left comparatively little *terra incognita* that had not been penetrated by the explorer, and this was the only remnant of undiscovered region that concerned us. If there was any profit to come out of the expedition, or any climatic benefit, doubtless Hobart would derive the advantage. Hobart was the starting point of the last Antarctic Expedition, and he remembered the sailing of the Erebus and Terror. They had also the work of Lieutenant Hooker remaining amongst them as a standard work, and the meteorological observatory established here had proved of benefit. There was a general desire to see the far South explored, to find out if there were any fresh discoveries to be made, and he thought, whether the money came from individuals or the Government, they would all be glad to see Tasmania take part in the expedition.

Mr. A. MORTON said that in 1886 the late Mr. Sprent read a paper on this subject, and it was then contended that there should be a combination of the colonies in carrying out the expedition. The project fell through at that time until now, when it was again revived. He called attention to the footnote in the circular—"Subscriptions will be returned in full in the event of the expedition failing to start from Hobson's Bay"—and said he had written for further information on the point, as to whether the same object might not be attained by the expedition starting from Hobart or New Zealand if it was found more advantageous to do so. In 1886 Victoria led the way in this matter, followed by Tasmania, which was very enthusiastic, a deputation waiting on the Premier; afterwards New South Wales took the matter up. On this occasion Victoria again took first place, and he was glad to think that Tasmania was again second. He thought that on such an occasion the words of the late Mr. Sprent were worthy of recollection when he said, "It would be a standing disgrace to Australia if she took no part in the exploration of the seas that wash her own coast." (Hear, hear.)

Mr. Alfred J. Taylor said it seemed to him that if they wished to make the history of the future, they could not do it in a better way than by supporting the expedition now under consideration. He had received several communications from the Secretary of the Royal Geographical Society of Australasia on the subject, and he trusted that something practical would be done by the appointment of a committee in Hobart.

Mr. Curzon Allport said that this was a question which would involve considerable discussion, and he thought, in view of the other papers to be read that evening, that it would be as well if this subject was adjourned for future discussion. While agreeing with the last speaker as to the appointment of a committee, he totally disagreed with the proposal to make the paltry sum required a matter for the Government. The object of the Royal Society was to deal with subjects of this sort, and he hoped that they did not require to go hat in hand to the Government for the necessary sum. He considered that they would not be doing their duty if they followed the course proposed. He hoped they would be prepared to contribute a substantial amount to this object, and speaking for the Photographic Art Association, he had no doubt but that they would join in the contribution. Reference had been made to the Antarctic regions as a place of great mystery, but already they had been partially explored, and at next meeting he promised to produce a series of photographs of those regions, not taken by the Eurebus and Terror expedition, but by the officers of some French discovery ships. He had do doubt they would be of interest to the members. (Applause.)

Mr. T. D. Stephens seconded, and hoped the Council in the *interim* would continue its work, and place before the Society a practical scheme at next meeting.

The motion was agreed to, and the discussion adjourned.

Mr. A. Montgomery, M.A., Government Geologist, read a Paper, entitled "Notes of some Geological Observations on the West Coast."

Mr. R. M. Johnston said he was sure that the members had listened with pleasure to Mr. Montgomery's paper, which was very interesting to all geologists. He had travelled on several occasions across the island, and also from North to South, and the igneous rocks had also excited his attention, especially the serpentines and greenstones. He had observed at the Queen and King Rivers rocks similar to those described by Mr. Montgomery. Between that locality and Macquarie Harbour there is an interesting section showing the Upper Silurian rocks, and he had made a large collection of Upper Silurian fossils from that region. The sandstone to which Mr. Montgomery referred occurred in several places between the Queen River and Macquarie Harbour, and at the 14-mile Hut, near the Magnet Range. This sandstone in both localities is closely associated with the serpentines, and the former is very rich in the remains of brachiopods, on account of which this sandstone was originally called by him *Brachipodos Sandstone.* There was also a very important serpentine rock described by Mr. Chas. Gould in the neighbourhood of Ilfracombe which was associated with important iron deposits that failed to be worked successfully owing to the existence of chromium in a free state. He believed that a similar relationship existed in connection with the rocks near Penguin. The importance of this paper could not be over-estimated, and he hoped the reading of it would lead to new interest being taken in the science leading up to an intelligible account being prepared of the order of rocks from Mount Heemskirk on the west to Patrick's Head on the east.

Mr. **Curzon Allport** thought that the Secretary (Mr. Morton) was entitled to credit for the pains he took in arranging to have such excellent papers read before the Society. The paper just read brought before them matters of great importance, and he thought such an important subject could not be dealt with upon one evening. He suggested that the consideration of the paper should be adjourned till next meeting, when he would be able to produce some information on matters touched on in the paper, and also photographs of some of the districts on the West Coast.

Mr. **Alfred** J. **Taylor** seconded, and the motion was passed.

FERNS.

Mr. R. M. **Johnston** read some notes on a fern which had been found at George's Bay by Mr. George Hinsby, and was submitted to him by Mr. Leonard Rodway. He described it as belonging to the Bleechnum Cartaligenum, a species common to Australia, but hitherto unknown in Tasmania.

Mr. A. **Morton** read a paper entitled "A complete list of ferns found in Tasmania, with full descriptions of the genera and species," in which he had adopted the elaborate description, as published by Mr. G. Bentham, F.R.S., in his "Flora Australiensis," giving wherever practicable the authorities and localities where the fern is found, also the localities in which the species is found in the other colonies. It was his intention, if possible, to have the list of ferns of Tasmania illustrated.

Sir Lambert Dobson said that all those who took an interest in Botany would be be glad to find that a good description of ferns has been compiled. They had this shortly done in Spicer's book, but this would be much more complete, and would be of great interest to all who enjoyed a walk in the bush. Comparatively few knew the number and names of the ferns, but this book would enable them readily to identify the plants. At one time, when Sir Henry Lefroy offered a prize of £5 for the best collection of ferns, he made a collection of 50, comprising every fern he knew of in Tasmania. He was very much pleased to see that Mr. Morton had given his attention to this matter, a pleasure which would be shared in by all those who took an interest in this attractive branch of science.

A GUM TREE GRUB.

Mr. **Alfred** J. **Taylor** submitted the branch of a gum tree sent by Mr. Ward, Government Analyst, which had been eaten off by a grub.

His Excellency in moving the usual vote of thanks to those who had read papers, expressed the pleasure with which they had listened to Mr. Montgomery's paper, and hoped they might often receive papers from that gentleman. (Hear, hear.) He was sure that they all agreed that Mr. Morton's work would be of very great interest, and he had no doubt it would assist in cultivating a love of flowers among the rising generation. (Applause).

The vote of thanks was cordially passed, and the meeting adjourned.

SEPTEMBER, 1890.

The monthly meeting of this body was held on Monday, September 15. The President, His Excellency Sir R. G. C. Hamilton, took the chair. There was a good attendance of Fellows, and a large number of ladies were present, including Lady Hamilton.

NEW MEMBER.

Major-General Tottenham was elected a Fellow of the Society.

ANTARCTIC EXPLORATION.

Mr. Morton reported that at a meeting of the Council of the Society the following resolution was agreed to:—"That this Society desires to express its sympathy with the proposal for the despatch of an expedition to the Antarctic regions, under the conduct of Baron Nordenskïold, and resolves that active steps be taken to collect subscriptions in aid of so desirable an object, the Royal Society heading the list with a donation of £50."

Mr. Thos. Stephens moved the adoption of the resolution by the Society. Most of the members would agree that it was desirable that the little known country in the neighbourhood of the South Pole should be explored, and something more known of it. It was now something like 60 years since the last attempt was made to gain any information about these southern regions, and from various circumstances that experiment was practically abortive. Perhaps the most interesting discovery during the voyage of the Erebus and Terror was the two magnificent volcanoes named after the exploring ships, and which are, perhaps, without a parallel in the known world. He did not think that the expedition should be taken up in a commercial spirit, as was suggested by some friends in the other colonies, and with the almost certain project of re-establishing the whale fishing. If people started with a foregone conclusion of that kind, he was afraid that they would be disappointed. It was better that the expedition should rest on the ground that it was undertaken in that spirit of enterprise which was the peculiar property of the Anglo-Saxon race all over the world—(hear, hear)—and with a desire to get rid of that feeling of shame which they must have at knowing so little of a country which was comparatively close to us. Much would be gained in the cause of science and otherwise by a well equipped expedition. It was incumbent on all those who could do so to help in removing some portion of the veil which now hangs over the southern part of the world. He had pleasure in submitting the resolution for the approval and concurrence of the members of the Royal Society.

Mr. James Barnard seconded. Usually the Council possessed the power to transact all business of the Society, but when the resolution agreed to involved the expenditure of money, it was thought advisable that it should receive the concurrence of members. He did not propose to speak at length, as he considered that the subject had been thoroughly thrashed out, and it was like "painting the lily" to expatiate upon it. They were simply following the example of the Councils of the different societies of Australia in voting this sum, which was in proportion to their limited resources.

Mr. A. Mault did not intend to propose an amendment, but desired to explain why he should vote in the negative. It was because he so heartily agreed with almost every word Mr. Stephens had said that he thought the course proposed was unfortunate. They all regarded with something like a sense of shame the fact that they knew so little of a locality that was nearer to us than any other part of the world, but he did not think that that sense of shame would be taken away by the consideration of the fact that the work was proposed to be done, not by us, but at the instigation, and with the assistance of persons on the other side of the world who do not belong to our race or speak our language. He very heartily appreciated the motives which had induced Baron Nordenskiöld to make this noble offer, and would not say a word against it, but he still thought that in a matter of this sort it was a disgrace to the Australasian Colonies that the work should be in any way taken out of their hands, or conducted in a manner over which they could not exercise control. The Colonies were perfectly willing, as he was sure they were capable of doing the work, and if they took the matter in hand he was convinced that it would be much better than if done under what must be the divided counsels of people on the other side of the world and those now taking part in it from this side. The Australian Colonies were now beginning to found a Navy, and he hoped that it would gain as bright laurels in the South as the Navy of the Mother Country had gained in the North. He thought that it would be a great pity if the carrying out of such an expedition as that proposed should be in any other hands than that of the Australian Colonies.

His Excellency: It would be more in order if you propose an amendment.

Mr. Mault said he would rather vote against the motion a direct negative.

Mr. J. B. Walker suggested that voting on the question should be postponed until other matters relating to the subject were discussed, and this was agreed to.

Mr. A. Morton read a satisfactory progress report of the Joint Committee of the Royal Geographical Society of Australasia (Victorian Branch) and the Royal Society of Victoria, on the proposed Swedish expedition to the Antarctic regions. It stated that the Council of the Victorian branch of the Society had been authorised to head a subscription list in aid of the proposed expedition with a donation of £200 from the Society's funds. The starting point was altered from "Hobson's Bay" to "an Australasian port," and communication had been made with the various colonies in order to get the co-operation of the various Royal Societies in an appeal to the public for funds in aid of the proposed expedition.

Mr. J. B. Walker read a short and interesting account of the last Antarctic expedition, taken from Sir James Ross's book on the Antarctic expedition of the Erebus and Terror. The paper was illustrated by a map of the discoveries made, and in conclusion he said that whales existed in great numbers, and valuable seals might be obtained; while Ross spoke of enormous beds of guano which were practically inexhaustible. The result altogether would not, he thought, be of much value commercially, but of very great advantage to science in such problems as whether the South Pole, like the Northern regions, had once enjoyed a temperate climate, and what effect those regions had on the Tasmanian and Australian climates. The Antarctic regions were within a week's steam of Melbourne or Hobart, and he made an earnest appeal to Australasia to undertake the important work of exploring that region.

Mr. A. Morton read a paper entitled, "What Science and Commerce may gain from an Antarctic Expedition." He referred to the scientific results that had been obtained from expeditions to the North Pole in the way of the confirmation and correction of scientific theories relating to ocean currents, magnetic deviations, climatology, geographical distribution of plants, animals, etc. In respect to commerce, mention was made of the discoveries of the White Sea route to Russia and its consequent trade, the establishment of the Spitzbergen fisheries, and the opening up of new lucrative whaling grounds in Baffin's Bay. The result of Captain Ross's trip to the South Polar regions gave magnetic researches of the highest value. Although Captain Cook had predicted that no man would venture further than he had done, viz., lat. 71deg. 10min. S., Captain Ross had penetrated 420 miles further south from the point at which Captain Cook turned back. While heartily in sympathy with the proposed expedition under Baron Nordenskiold, he thought that £10,000, the amount proposed, would prove inadequate to obtain great results, or to win more information than had been already obtained. He suggested that England and Australia should unite in sending a properly equipped expedition to the Southern Polar Sea under naval auspices and naval discipline.

HIS EXCELLENCY said that the Society would now further consider the resolution before it.

Mr. A. J. TAYLOR thought that as it had been decided that the expedition should be a joint Swedish and Australian one, it would be a pity to throw difficulties in the way of carrying it out. At the same time everyone sympathised with Mr. Mault's objection, and he suggested that the motion should be amended to express regret that the expedition had not been taken in hand by the Australian colonies.

Major-General TOTTENHAM thought the Mother Country should also be asked to assist.

HIS EXCELLENCY asked Mr. Mault if the motion as amended by Mr. Taylor would be acceptable to him.

Mr. MAULT said he did not wish to oppose anything that the Council of the Society thought expedient, but he thought that everything said subsequently to his remarks had confirmed what he had said. The noble words of the *Argus* in regard to the glory that awaits Australasia in accepting this duty, and the equally noble words of Mr. Walker, should have actuated a little more the different learned societies that have taken up this matter. It was a descent from this noble incentive to think that they were doing their duty by sending £5,000 from Australasia to help the Swedes to carry out the expedition. He could not accept any modification of his views, as had been indicated, but thought the question had better be debated on its merits, and the question decided whether they should or should not assist in this movement.

Mr. J. B. WALKER supported the motion. He would have preferred that England and Australasia should have taken up this work, but he was afraid that years would elapse before they were stirred up to the point of enthusiasm under which they would undertake the work. He thought that when Baron Nordenskïold, an experienced navigator, offered his services, and also to pay one-half of the expense, if Australasia would supply the other half, it would be ungenerous to say that they would not help. At the same time he hoped that this expedition would be the precursor of one of which Australasia might be proud. (Hear, hear.)

The motion was then put and carried.

Mr. JAMES ANDREW moved,—"That the Council of the Society carry out the work in connection with the proposed expedition."

Mr. J. B. WALKER seconded, and the motion was agreed to.

STRIKES AND REAL WAGES.

Mr. R. M. JOHNSTON read a paper entitled "Observations on the Influence of Strikes upon Real Wages." He described himself as one who regarded combination or co-operation amongst wage-earners as of paramount necessity to them, and that when all better modes of appeal for reasonable concessions are unavailing, the last and terrible resort "to strike" may in certain cases not only be justifiable but imperative. But a strike could only succeed in raising real wages when it was partial or confined to industries that comprise a small proportion of the community. A strike might be the means of successfully raising the status of some branches of labour that are comparatively underpaid or overworked; it might raise the real wages of a particular country or locality which formerly laboured under the average remuneration of other countries; it might temporarily be the means of forcing the capitalist or employer to give a fairer or larger share of the profits of capital and labour, *i.e.*, machinery, plant, skill, and labour—but from the very nature of the common source of all profit and wages, viz.—the current products created by the combined services of capital (instruments) and labour), strikes could not raise the real wages of all wage-earners. Strikes could not increase the real wages or the purchasing power of a day's labour of all wage-earners. In a word, they could not divide more than what has actually been created or produced, although the nominal rates of wages and nominal prices of commodities may both be raised to any extent without real benefit to anyone. To secure a general nominal rise of wages in all branches of labour would further have the immediate effect of lowering once more the real wages of those who already had effected for themselves an advantage by successful combination or strikes. Strikes might possibly raise the nominal wages of workers all round a hundred-fold, and yet result in the positive lowering of the real wages of all workmen who, by means of organisation, hitherto have succeeded in bettering their condition as compared with their less perfectly organised fellow-wage-earners. It was the failure to recognise the essential difference between real and nominal wages that rendered futile the many schemes of sentimentalists, which have for their object the laudable design to improve the condition of the people. In conclusion, he thought it would be well for capitalists and wage-earners, employer and employed—whose interests as producers and consumers are almost identical—that when matters requiring adjustment are proposed, there should be greater facilities afforded to the Councils of both interests for securing a friendly settlement. To the absence of these facilities, and the adoption of high-handed action, was mainly attributed the disastrous evils of strikes.

Major-General TOTTENHAM suggested, as a solution of the labour difficulty, that wages should be fixed for a year, and a month's notice given of any change.

HIS EXCELLENCY thought it would be better that the discussion be confined as much as possible to the statistical and scientific effect of strikes. (Hear, hear.)

Mr. MAULT said that if the discussion was to proceed on the lines suggested, an opportunity should be afforded of considering the paper read. He would move the adjournment of the debate.

This was agreed to.

THANKS.

His EXCELLENCY moved a vote of thanks to the gentlemen who had read papers, and a special vote of thanks to Dr. Agnew, who had presented the Society with three volumes giving a report of the scientific results of the exploring voyage of H.M.S. Challenger, 1873-76. The volumes are beautifully illustrated.

The votes of thanks were cordially passed, and the proceedings terminated.

OCTOBER, 1890.

The monthly meeting of this body was held on Monday, October 13. The chair was occupied by the President, His Excellency Sir R. G. C. Hamilton, and there was a good attendance of Fellows. Several ladies were also present.

NEW MEMBERS.

The following gentlemen were elected Fellows:—F. J. Jacobs, J. H. Downie, W. G. Browne, L. Chambers.

Mr. T. A. Urquhart, of New Zealand, was elected a corresponding member.

The secretary drew attention to three specimens of Salmonidæ hatched from the late shipment of ova brought out by Sir Thos. Brady, the gift of the Hon. J. W. Agnew. The fish were obtained from the Salmon Ponds, one answering undoubtedly to the description of the true salmon, the other two being unmistakably trout, clearly showing that with all the care and attention paid to the selection of true salmon ova by Sir Thos. Brady, certain ova of trout had been sent out with the late shipment It was extremely satisfactory to learn that, although there appeared to be a mixture, a very large percentage agreed to the description of the true *Salmo salar*. He also directed attention to the fish caught on Saturday in the Derwent, which, he said, although a very fine fish, did not agree with Gunther's description of the true *Salmo salar*, but similar to the fish recently caught in the Huon by the President. A gentleman passing through Hobart, and whose experience in the matter was that of having been a manager of a Scottish salmon fishery, had viewed the fish, and pronounced it to be a bull trout.

Mr. JOHNSTON questioned whether the different circumstances surrounding the fish in these waters had not occasioned a breakdown of the racial distinctions between the *Salmo salar* and the *Salmo trutta*, together with the theoretical classification of the true *Salmo salar*. The circumstances also tallied with the experience of New Zealand in this matter.

Mr. MAULT asked had this change of the surroundings had any effect upon the quality of the fish.

Mr. JOHNSTON considered the flavour qualities of the fish would be equally affected with the other qualities of the fish. The question he had just raised had never been put to any Home authority. This degeneration of the qualities of the fish was experienced in different waters in Scotland, the finest fish being found in the colder waters.

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Secretary stated that he had received a letter from Professor Hutton, of the Canterbury University, Christchurch, New Zealand, stating that the New Zealand Government had passed a vote of £500, and that the Government Printer had been instructed to do all the printing required by the Association free of charge; also that the hon. sec. had been authorised to frank all telegrams, letters and parcels in connection with the Association. The meeting to take place in January, 1891, and considering that the next meeting would be held in Hobart the following January, 1892, it was to be hoped the Government would act as liberally as the New Zealand, Victorian, and New South Wales Governments had done, the two latter having voted sums each to the Association.

Mr. R. M. JOHNSTON said as the New Zealand gathering was approaching it would be well to get an expression of opinion from the people of the colony and the Government as to the welcome which would be extended to the Association, because this should be ascertained before the meeting in question, so that the representatives of Tasmania might be in a position to reiterate their previous invitation to the Society to hold its 1892 meeting in Hobart. He moved that the Council wait on the Government, and ascertain what they are willing to do in the matter.

The motion was agreed to.

ANTARCTIC EXPEDITION.

A subscription list for this Expedition was laid on the table.

TASMAN'S JOURNAL.

Mr. J. B. WALKER read a paper on "Notes on the localities mentioned in the journal of Tasman's discovery of Tasmania." In this he sketched the two voyages made by Tasman, in the first of which he discovered Tasmania and New Zealand (1642), and in the second of which he explored the west, north-west, and north coasts of Australia and the Gulf of Carpentaria (1644.) These voyages completed the circumnavigation of New Guinea and Australia. The writer then proceeded to identify the parts of the Coast mentioned by Tasman, and the conclusion he had arrived at regarding the land fall made by the discoverer was that it was the high land north of Macquarie Harbour. He then proceeded to discuss the site of Tasman's anchorage on the East Coast near Cape Frederick Henry, and pointed out that the name of Frederick Henry Bay, now applied to part of Storm Bay, was originally given by Tasman to what is now known by the name of Blackman's Bay.

Mr. MAULT described a method in which he had traced Tasman's land fall, fixing it slightly further south than Mr. Walker. There were three maps in the British Museum among the additional manuscripts, No. 8,946, which had never been published. It would be well if the Government could be got to publish these.

NEW TASMANIAN SPIDERS.

Mr. MORTON stated that he had lately been making a collection of Tasmanian spiders. Some of them he was unable to determine, and had forwarded to Mr. A. T. Urquhart, of New Zealand, the collection for examination. Mr. Urquhart was one of the best authorities in the colonies on spiders, and on examining the collection he had found some new species of the genus *Eperidæ* five new kinds of that genus, two new species of the genus *Thalaosoma*, while he had been able to form two new genera which he had named *Alrea* and *Collina*. Accompanying the paper was a plate of the species referred to.

OSTRICH FARMING.

Mr. JAMES ANDREW read a paper on the subject of ostrich farming, and the possibilities of successfully introducing this industry into Tasmania. The remarks set forth were based on personal observation of wild ostriches, and experience of the management of the bird in a domesticated state. After a brief sketch of the bird and its habits, together with some of the uses to which the eggs are put by Bushmen, the writer proceeded to deal with the subject of ostrich farming, and pointed out that the Egyptians were the first people who had undertaken the taming and utilisation of the bird. The first modern step in this direction occurred rather less than 30 years ago in Cape Colony. It was not necessary to have large enclosures in which to confine the domesticated birds for herding purposes. but each pair required to be separated. The male bird was most pugnacious during the nesting season, and could only be approached in safety with great precaution. The formidable character of a kick from an ostrich was exemplified by the fact that at Graff Reinet the back of a horse was broken by one such blow. The best means of escaping injury when attacked by the bird was to lie down and submit to the inevitable pummelling he would administer. The writer inclined to the natural hatching of the eggs by the birds as preferable to the use of incubators, although the incubator was an essential appliance for use in the case of emergencies. The process of clipping and preparing the plumage for market was described, followed by examples of high prices paid a few years ago—the halcyon days of ostrich farming for both bird and plumage. The growth of the industry in Cape Colony was such that from 80 tame ostriches in 1865, in 10 years the total had reached 32,247, and the export of feathers was 49,969lb., valued at £304,938, and in 1882 feathers were exported to the value of £1,093,939. Recent statistics showed that the supply had exceeded the demand, and the enomous profits arising in the past from the sale of the young birds and feathers would never again be realised, but substantial recompense would still be earned by a skilful and intelligent management. The bird could be raised in any temperate climate, and dry level wastes might be found suitable for the industry. In Africa the birds had so lost their value they were not worth recovering when they strayed, and it was proposed to repeal the Act protecting the bird.

COMPLIMENTARY.

The **President** moved the usual vote of thanks to the contributors of papers, after which the meeting adjourned.

NOVEMBER, 1890.

The last monthly evening meeting of the present Session was held on Monday, November 17th, 1890. The PRESIDENT, Sir R. G. C. Hamilton, was in the chair.

NEW MEMBERS.

Messrs. A. J. Ogilvy and A. R. Browne, M.A.M.I.E., F.G.S., were elected Fellows of the Society.

AUSTRALASIAN ASSOCIATION.

The Secretary (Mr. A. Morton) read a letter from the Hon. P. O. Fysh, Premier, intimating a vote of £500 from the Government towards defraying the expenses attendant upon the 1892 session of the Australasian Association which is to be held at Hobart. He also intimated that congratulations had been received from New South Wales, Victoria, and New Zealand, at the proposed arrangements for holding the meeting here in 1892.

STRIKES AND WAGES.

Mr. A. J. OGILVY read a paper, in which he asked the question, Can the toiling masses really improve their condition by these incessant and unhappy strikes, or are they only beating their hands against the iron bars of inexorable economic law? The paper was a reply to the paper read by Mr. R. M. Johnston at the September meeting on the influence of strikes on real wages. Dealing in the first place with the question as it affected primary industries, that is those which are concerned in extracting or producing the raw materials of wealth from the land as in agriculture or mining, he contended that in all such industries every increase of wages would come out of rent. He regarded rent as the surplus which remained after paying working expenses and tenants' ordinary profit. Every rise in the expenses or fall in the profits would reduce the rent proportionately, and, therefore, he concluded that in every department of industry which is concerned in supplying the raw material of wealth from the land, every enforced rise of wages will be clear gain to the labourer, but the loss would fall on the landlord, and stay there. In the secondary industries of manufactures and commerce which were engaged in working of and distributing the material produced by the primary industries, increased wages signified increased price of goods. Those goods were of two kinds—those which the masses consumed, and those which they did not. After pointing out that a vast proportion of industry was concerned in providing luxuries and enjoyments for the rich, he concluded that in all those commodities which the underpaid do not consume, the loss due to increased wages would fall upon the overpaid, and stay there, again leaving the whole net gain to the labourer. On those goods which the masses consumed the strikers would suffer loss, but the loss would not equal the gain. It was said that if the upper classes lost so much there must be so much less employment for labour, and so the loss will come round to the labourer after all. He maintained, however, that there would be no less employment. For, he asked, why will the upper classes have got so much less? Simply because the lower class have got so much more. It is not a loss, but a mere transference of employing power. What the masses want more money for is to spend it, and they can only spend it in purchasing goods and hiring services just as the upper class did They will in short, to the extent of the transference, be employed by each other instead of by their old employers. There was, of course, a limit to the rise of wages, but this limit was a long way off. The labourer could not earn more than his labour produced, but what the labourer actually got was a very small portion of what his labour produced. In conclusion he pointed out that a more equitable distribution of the produce of labour was a boon so great in itself as to be well worth some cost, and that we need not be dissatisfied because less luxuries are produced for the few very rich, if more comforts are provided for the many poor; not even though the loss in value on the luxuries exceeds the gain in value on the comforts.

Mr. R. M. JOHNSTON read a paper criticising Mr. Ogilvy's views. He said it afforded him great pleasure to find himself in agreement on so many points with one like Mr. Ogilvy, whose well-known generous sympathies for the amelioration of the condition of the masses of the people must command the respect of all right thinking persons. He took exception, however, to several of Mr. Ogilvy's arguments, notably to that regarding rent. He favoured Ricardo's theory, now almost universally accepted, that "the rent of land is determined by the excess of its produce over that which the same application can secure from the least productive land in use." He also laid it down as an accepted doctrine of political economy that rent formed no part of the price of agricultural produce. He dwelt at length upon this point, and illustrated by a table that any increase in wages must fall upon consumers and not upon rent of landlord or the profit of the capitalist. He combated the idea that the rich spent more in luxuries, pointing to the large sums spent by the working classes in liquor and tobacco. He held that Mr. Ogilvy's objections to his papers were based upon assumptions which could not be sustained when subjected to close scrutiny, and he could only re-affirm that it was by increase of savings properly applied in the creation of instruments, which will still more greatly multiply the power of man that any improvement in the condition of the masses can be successful. Without this the mere raising of wages could only benefit a few industries at the expense of the many.

Mr. OGILVY said that the Society had now the two aspects of the question before them, and it was for the members to judge. Mr. Johnston had based his arguments principally on the generally accepted opinion of Ricardo, but it should not be forgotten that the British Parliament had repudiated it, in regard to the Highlands of Scotland and Ireland, by the establishment of Land Courts, which introduced an artificial element into what was held by some economists to be a natural law. In regard to what Mr. Johnston said about the rent forming no part of the price of agricultural produce, there were some farmers present, and he asked them if they had to pay twice as much as they now did for their labour, would they pay as much rent?

Mr. W. E. SHOOBRIDGE also spoke on the subject at some length, pointing out that the prices of labour were to a great extent fixed by combinations which had been the secret of the success of all strikes. He hoped the time would speedily come when arrangements would be made whereby the labourer could get his fair share of the products of labour without recourse to strikes.

ACTINOMYCOSIS AND TUBERCULOSIS.

Dr. BARNARD read a paper on this subject, dealing with its transmissibility of bovine diseases to human beings by the consumption of the meat of diseased animals. He showed that such diseases had been transmitted. A central Hygienic Institute was recommended by the last Intercolonial Stock Conference, to which all cases of disease amongst animals should be referred from all the colonies. Without some such institution it was not easy to see how they could be informed to what extent these diseases prevail in our midst. He considered that a similar institution should be founded in connection with the Health Department of this colony, as modern science now was not content with mere superficial examination, but proceeded with more strict and reliable methods to detect the micro-organisms which are undoubtedly the active agents in the production of disease. The paper was illustrated by microscopical specimens of these diseases prepared by Mr. Archibald Park, M.R.C.V.S.

COAL SPECIMENS.

Mr. Curzon Allport showed a number of specimens of coal from the mines at New South Wales, and New Zealand.

PRESIDENT'S ADDRESS.

The President then delivered the following address :—

Fellows of the Royal Society.—During the session of 1890, which this evening comes to a close, the number of our Fellows has been increased by sixteen, and of our Corresponding Fellows by two. The additions to our library have been very satisfactory, and include the three handsome volumes containing the record of the Challenger Expedition, for the gift of which we are indebted to our honorary secretary, Dr. Agnew. I am personally gratified to learn that the Encyclopædia Britannica, which I presented to the Royal Society in the beginning of the year, is being largely referred to by members, who find it of much assistance to them in some of their studies and investigations. The annual proceedings of kindred societies throughout the world, which form perhaps the most important part of our Library, are constantly increasing, and here I would point out that, having regard to the time which often elapses before such volumes are printed and distributed, we may regard with some satisfaction the fact that at our opening meeting this session we had on the table the printed proceedings of our Society for 1889. It is true that this is the first time that this has been done, but I think we may feel pretty sure that our energetic secretary, Mr. Morton, having accomplished this once is not likely to observe less promptness in the publication of our annual proceedings in future. Our monthly meetings have been well attended, and 22 papers have been read before us. In Zoology we have had five papers. The first by Mr. R. M. Johnston, entitled "Further Observations upon the Fishes and Fishing Industries of Tasmania, together with a revised list of indigenous species." Eight years have elapsed since Mr. Johnston contributed a similar paper to this Society, and during that time, from additions made mainly by Mr. Saville-Kent, Mr. Morton, and Mr. Johnston himself, the 188 species then known have increased to 214. The next, also by Mr. Johnston, on "Tasmanian Mollusca," in which he points out how much there is to be done in connection with this subject to secure a satisfactory classification of species. Then we have had a paper by Mr. A. T. Urquhart, of New Zealand, on some Tasmanian spiders sent to him by Mr. Morton for examination, in which he pronounces the collection to contain not only several new species but also two new genera. Mr. Morton contributed an interesting paper on a recent dredging trip in the River Derwent. He was fortunate in being accompanied on this trip by Mr. A. Durrand, a Fellow of the Royal Microscopical Society, who has made a collection of foraminifera from many parts of the Southern Seas, and who, it will be remembered, at one of our meetings exhibited some interesting microscopical preparations of these, and of other minute marine organisms. Owing to the primitive description of dredge used on this trip, the results from a scientific point of view were not so great as they might have been, but they were quite enough to justify Mr.

Morton in determining to carry out in the summer months of this year a more complete system of dredging, similar to that adopted by him some time ago on the coast of Queensland. The last paper bearing on Zoology was read by Mr. Andrew on ostrich farming. In this paper he gave, from personal observation and experience, some account of the bird and its habits when in a domesticated state. In Geology we have had from Mr. Johnston and Mr. Morton a description of a second ganoid fish from the Lower Sandstones near Tinder Box Bay, similar to the one discovered last year, which the discoverers named after me, *Acrolepis Hamiltoni*. Mr. W. A. Montgomery read "Notes of Some Observations of the Geology of the West Coast," a subject which is of particular interest at the present time, and Mr. Barnard, our respected vice-president, brought under the notice of the Society some notes by Mr. S. H. Wintle respecting a fossil tree found beneath a hundred feet of basalt. In botany we have had some notes by Mr. Johnston on the discovery of a fern, hitherto unknown in Tasmania, although found on the continent of Australia, and Mr. Morton has compiled "A Complete List of Ferns found in Tasmania, with Full Descriptions of the Genera and Species." In this list, which will be invaluable to students and collectors, he gives so far as is practicable the authorities and the localities in Tasmania where each fern is found, and the locality in which the species is found in the other colonies. In this section also Mr. A. J. Taylor read two papers, one on coco-de-mer, and the other on the native hop as a cure for hydatids. In meteorology we have had a paper from Mr. E. C. Nowell on the influence of the moon on the rainfall, and on this paper Captain Shortt made some interesting remarks in which he stated that his observations showed that the influence of the planets also over the weather is considerable, and he promised a paper on this subject on some future day. Dr. Barnard has submitted to us a very important paper this evening on "Actinomycosis, Human and Bovine, and its relations to Tubercolosis, illustrated by mounted specimens prepared by Mr. A. Park, M.R.C.V.S." From Mr. J. B. Walker we have had two further contributions respecting the early discovery and settlement of Tasmania, the first entitled—"Notes on the localities mentioned in the journal of Tasman's discovery of Tasmania," and the second on the settlement of Northern Tasmania, in which he describes the discovery and occupation of Port Dalrymple and the River Tamar. Mr. Walker also contributed a paper on the Antarctic Expedition of the Erebus and Terror. This latter paper, although only a compilation from Sir James Ross's book, is of much interest at a time when further Antarctic exploration is being carefully considered and discussed. In connection with this subject also, Mr. Morton read a paper on "What science and commerce may gain from an Antarctic expedition." The interesting correspondence which has taken place with the Royal Society of Victoria on this subject will, of course, be printed with our proceedings. Baron Oscar Dickson has undertaken to furnish an expedition which Baron Nordenskiold is to take command of, provided the Australian colonies contributed £5,000—a moiety of the estimated cost of it. Our Society has voted £50 out of its funds towards this object, and further contributions will, it is hoped, be forthcoming. Although it is, I believe, the general desire of our members, and, I may say, of Tasmania generally, to do our part in helping forward this scheme, the munificence of which on the part of Baron Dickson we so heartily appreciate, yet there is, I gather, a strong feeling in the community generally that it will only be by a fully equipped expedition, involving a very much greater outlay than £10,000, under the British flag, promoted jointly by Australia and the Mother Country, an expedition which will have to pass at least one winter in the Antarctic circle, that the many interesting questions now locked up in that imperfectly unexplored region can be fully settled. In Social Science we have had two papers from Mr. Johnston, the one, "Root matters in social and economic problems" (second series), and the other, "Observations on the influence of strikes upon real wages." This second paper of Mr. Johnston's was followed by the paper entitled "Can strikes really improve the condition of the masses?" read this evening by Mr. A. J. Ogilvy, whom we are glad to welcome as a new working member of this Society, and by Mr. Johnston's rejoinder. Such subjects do not admit of the mathematical demonstration of a problem in Euclid, and difference of view will prevail. But we may congratulate ourselves on the presence amongst us of two such able exponents of the different views held on this subject, and it is only by full and free and fair discussion in a science like this, if indeed science it can be properly called, that truth can be elucidated. At our first meeting this session, Mr. Barnard gave us some account of the meeting in Melbourne in January last of the Australasian Association for the Advancement of Science. He drew our attention to the fact that it had been provisionally settled at that meeting that the gathering of the Association for 1892 should be held in Hobart. This provisional arrangement will have to be confirmed at the meeting of the Association, which is to be held in Christchurch New Zealand, in January next, but there is little doubt that this confirmation will then take place, and that we shall have the privilege of welcoming the Association in Hobart in January, 1892. You have heard read this evening the letter of the Premier respecting the contribution of the Government towards the expenses which will be incurred on this occasion. I think we may regard this letter as quite satisfactory, and I confidently look forward to the meeting of the Association in Hobart in 1892 being a thoroughly successful one. I will do my utmost to secure the presence at this gathering of some distinguished man of science from the old country, but of course I cannot be sure that my endeavours in this direction will be successful. You may remember that the cablegrams some time ago announced that Professor Huxley was on his way to New Zealand by way of the Cape, and I took the opportunity of referring to this at one of our meetings, and suggested that we should prepare for his reception in Hobart, which he was to touch on his way. Unfortunately this rumour proved to be incorrect, but I have always understood that the Professor had it in contemplation to visit Australia some time or other, and it would be a great triumph if we could secure his attendance during the meeting of the Australasian Association for the Advancement of Science, to be held in Hobart in 1892. Although the work of the session is very creditable we might well have received more contributions from our members. With the single exception of Dr. Barnard, whose important paper has been read this evening, we have received no contribution this session from any of our medical members, who from their scientific knowledge might in so many directions have produced interesting work for us; and I would again press upon their attention that we should much value a more active co-operation on their part in the work of the Society. In conclusion, I would desire to record our thanks to those members who have submitted papers to us, and particularly to Mr. Johnston, whose versatility is as great as ever; to Mr. Morton for the energy and ability displayed by him in the discharge of his duties as our secretary; and to the Press for their full reports of our proceedings.

On the motion of Bishop MONTGOMERY thanks were voted to His Excellency for his address and for presiding at the monthly meetings.

The proceedings then terminated.

ROOT MATTERS IN SOCIAL AND ECONOMIC PROBLEMS.

By R. M. Johnston, F.L.S.

(2nd Series.)

Natural Limits to the Numbers Engaged in Various Occupations.

Most writers on social problems tacitly assume that no other considerations than those of supply and demand, or competition and remuneration, need be taken into account when questions relating to the numbers that may be employed in the various branches of human industry are concerned. Indeed so able an exponent of the principles of Political Economy as Mr. Henry Sidgwick, assumes with confidence that the adjustment of the apportionment of the employed in the various divisions of industry is sufficiently determined by "rates of remuneration." He states (p. 182 "Principles of Political Economy"): "We assume that labour and capital are *mobile* or capable of being attracted by a higher rate of remuneration, both from district to district, and from industry to industry, so that not merely are the wages paid for the same quality in any one industry approximately the same, but also when the remuneration of labourers or capitalists in any industry is known to be higher than that of labourers or capitalists in some other industry entailing no more sacrifice or outlay, and requiring no scarcer qualifications, the difference tends to be gradually reduced by the attractions which this higher remuneration exercises on actual or prospective labourers or employers."

There is not the faintest recognition here of natural limits to or absolute necessity for employment in a given direction, irrespective of the aggregate intensity of energies expended, or market rates and prices. Neither does he recognise the universal truth in matters animate and inanimate, that mobility or movement in a new direction requires a fresh expenditure of force commensurate with the nature of the subject, the time occupied in transition, and the friction to be overcome due to inertia or foreign resisting media. A physicist would never dream of discussing the mobility of material substances in such a loose way. He would first consider the mass or weight of the substance: the distance and direction of movement: the rate of movement and time: and the friction due to inertia or existing diversity of movement: and from these he would compute the fresh demand upon energy or force to execute the desired movement.

Because the Political Economist does not think, or does not choose to think, that the transfer of a labourer or capitalist to a new place, or to a new kind of occupation, involves a process analagous to the movement of inanimate bodies, it is not the less true. Take the case of a shoemaker reduced to a state of idleness, or partial idleness, by competition among excessive numbers, or some other cause, locally or generally.

We will suppose that this workman has a family of 5 persons, including himself, to provide for, in addition to his quota of expenditure required for State purposes, such as General Government, Law and Protection, including Gaols, Military and Naval Defences, Police, Education, Public Hospitals, Asylums, support of Paupers, etc.

It is obvious, therefore, that when fairly employed in this branch of labour—making boots and shoes—he is not merely rendering reciprocal services to his countrymen, but he helps them to provide for such expenditure as the requirement of the particular State demands. The greater the effort or energy expended by him during the year, the greater is the value of products by him added to the common wealth, in all these respects, in addition to the important part of support of the four dependants specially related to him.

Under ordinary circumstances (excluding foreign interference, and making due allowance for special skill), all branches of services within a certain country are paid at rates of wages which are, broadly speaking, correlative to effort or time expended, and consequently so long as the rates of wages are locally proportionate to definite effort and skill, it matters not whether the average rate per hour be nominally high or low, so long as expenditure is also determined locally by such correlative conditions. Thus, take the following illustrations: Suppose the price of bread is determined by a daily effort of 10 hours, and that all other services are modified and constantly exchanged in prices which, whether high or low, are also proportional to the *nominal price* of, say, the *quarter of wheat.* Under such circumstances it would not matter to the shoemaker whether the *nominal* amount of his wages was high or low, for it would have the same *purchasing power* over the things which he required to satisfy the wants of himself and family, besides the proportion required from him for the *service* of the State. Thus if the standard—the *quarter of wheat*—bore always the same relation to his remuneration for 10 hours labour and to the various items of his expenditure, it mattered not a whit to him whether the nominal money cost of wheat was high or low. In Australia the average relation between a breadwinner's effort expended and a quarter of wheat usually represents $44\frac{1}{2}$ hours labour, equal to $5\frac{1}{2}$ days labour (8 hours) nearly. If, therefore, the quarter of wheat, and other things (including expenditure) always bore a corresponding relation to each other, as $44\frac{1}{2}$ hours common labour bears as the equivalent to one quarter wheat, it follows of necessity that nominal prices, whether high or low, would not increase or decrease his receipts or expenditure, nor his average gains or losses. Thus, so far, the various divisions of labour within any one State would never be affected in reciprocal interchanges with each other by alteration in the nominal cost of services, so long as the alteration in cost was a general one within the State, and governed solely by local natural conditions. But a different result would follow, so far as the shoemaker is concerned, if manufactured boots and shoes were largely introduced from a country where nominal money prices were generally much lower, or where the average breadwinners of the population—reduced to a perilous condition—were forced to increase their expenditure of daily effort relative to the standard of cost of one quarter of wheat to 89 hours, or $7\frac{5}{12}$ days labour of 12 hours per day. The local shoemaker would not have the advantage of distance and cost of transit, as in the case of the local quarryman or coal miner, for shoes and boots can be transferred long distances at a relatively small cost, and hence, if not protected in some other way, the local shoemaker would be unable to compete with the foreign low-paid worker. Not only would he have to increase his efforts to the same extent as the foreign competitor, but, were it not impossible, he would have to *exceed* his efforts before he could drive the foreign competitor from the field; failing this he would be reduced perhaps to half-time employment at the foreign rate of wages, and, probably, soon he and his family, overwhelmed with poverty, would become local victims to competition; and instead of being a help to the State would become dependants upon the rest of the breadwinners, thus increasing their State burdens.

It is usual with theorists to talk lightly of the *mobility* of labour under such circumstances, and to show that the local shoemaker, finding himself unable to compete in his capacity as shoemaker, would at once transfer his services to some other branch of labour, where it is supposed by theorists that there is always some providential provision. But all such writers do not seem to be aware that in a country where manufacturing industries do not dominate, there is a tendency to narrow the scope of operations, and to close more and more the doors of entrance to the remaining branches of active industries in proportion to the number of local industries actually driven out of existence by the influx of foreign manufactures. This is undoubted so far as the local market is concerned. No one can affirm with reason that an industry driven out does not correspondingly delimit the demand upon the *local market.* Logically, therefore, the only direction in which our shoemaker could maintain his existence as a breadwinner would be (1.) To convert himself into a labourer in raw products, for which there is still a profitable demand in *foreign markets.* (2.) Transport himself and his family to a country where his particular services are in demand, or (3.) Starve or become dependent paupers supported by the local State, already too heavily burdened by Poor Rates, etc.

In theoretical discussion this case would be disposed of by wordy wrangling, or special pleading; indictment of the capacity or lack of reasoning power of opponents; references to alleged harmonies of competition; and to dogmas and general conclusions of various Political Economists of accepted authority.

The usual ruts of controversy may afford ample opportunities for theorists to display literary skill, aided by the usual handy assortment of stock illustrations. But instead of a literary sham-fight, let the theorist enter into the real difficulties by discussing the matter practically with the distressed shoemaker. For this purpose we will take a common incident in these colonies.

A DEPUTATION FROM THE SHOEMAKERS DRIVEN OUT OF EMPLOYMENT BY COMPETITION WITH CHEAP FOREIGN MANUFACTURES.

Shoemaker, Spokesman for Deputation. *Theorist,* representing the Government.

Shoemaker.—On behalf of myself and my distressed fellow-workmen and their families, I have been asked to represent to the Government the terrible distress into which we have fallen by the influx of manufactures of boots and shoes from Europe at such low prices that we have not only been knocked off employment by local manufacturers, who were unable to compete with foreign houses, but we find that as individual workmen, with such high ruling rates in rent, clothing, and other necessaries, besides a high local taxation, we are unable to earn enough to maintain ourselves and families—even if we were able to get *full employment* at the foreign selling prices.

Theorist.—I sympathise deeply with your distress, but we cannot interfere with the laws of free interchange. You must therefore seek employment in some other way.

Shoemaker.—But we cannot turn our hands to another trade, and even if we tried, we would have to spend years as apprentices. Even in our own trade we had as young men to spend three or four years as apprentices, partly or wholly supported the while by our parents. Now we have no such help. On the contrary, we are each burdened with the support of a family. Even if we could manage for ourselves, what is to become of our families in the meantime?

Theorist.—I admit this difficulty, but is there not plenty of work open to you in this country, where you could turn your labour to account where no special skill is required, or, at any rate, where bone and muscle is all that is necessary.

Shoemaker.—True, in time some of us might obtain work as labourers in the field among farmers, or on public works or mines; but the failure in our own industry, in such a thinly populated country, causes a depression in nearly all local occupations; for it must be admitted a considerable portion of the products of other trades and industries have been directly affected by our distress and lessened consumption due to our lack of purchasing power. Besides, I have been told by farmers that they have themselves long struggled with adverse circumstances in competing against more favoured agriculturists in America—who are able to sell in European markets—our only customers—at prices which tend to become lower year by year, and if a local market is not soon established, many of them will have to give in. If other trades in turn are crushed by foreign competition as we have been, what hope have the farmers of holding on, let alone the outlook for their own children, where every branch of industry seems to be already overstocked, even in this rich and extensive country, with a sparse population. In addition to what I have stated, I am informed by those who have given much attention to agriculture, that there is only a limited amount of land whereon agriculture might be successfully carried on, but this form of industry will not admit of the employment of more than 35 persons to the square mile of land in cultivation; and if this be so, and if farmers cannot exchange products of the same kind with each other, how can a local market become a possibility in the absence of a local community of trades and manufactures?

Theorist.—I admit that the home-trader and home-workman may *temporarily suffer loss* from the competition of foreign traders and workmen in the same branch of industry; but it must be remembered that *everything* will again be adjusted, because capital is constantly exerting a tendency to *smoothe down* any *temporary inequality* in the profits of different trades. Even if you suffer from foreign importations the Government is not bound to protect you: for there can be *no right* which has a juster claim than that every individual of the community should be freely permitted to obtain commodities where he can buy them on the cheapest terms, and to sell them where he can realise the highest price.

Shoemaker.—It is easy for theorists to write such things. I am unable to understand exactly what you mean by suffering a *temporary loss*, or what the process may be which you euphoniously term a tendency to *smoothe down any temporary inequality.* I and my fellow-workmen are now unemployed. Many of us with our families are in great distress. Without *instant employment or relief from some source many of us will die of starvation.* We have no means, and if we had we do not know where to go to better our miserable condition. Do you mean if many of us succumb and die from want and misery, thereby thinning our own ranks as competitors for the existing small field of employment still remaining—that *this is the smoothing down process* to which we are referred for comfort. Good Heavens, surely not this? Remember that we are human beings, not machines! The machine may stand idle for a time and live; men cannot. Friction in inanimate machinery means dissipation of power in heat. With men friction means distress, misery, and death. Men are not machines, and loose analogies based upon the laws of physical processes cannot be grimly applied to men fighting for life and exposed to suffering. You say that Government is not bound to protect its own workmen, and that there can be no right having a juster claim than that every individual should have the most absolute freedom in buying in the cheapest market and selling in the dearest, irrespective of any local claims of sympathy, or national or racial ties of common interest. Such a commercial law, not bond, cannot be consistent with the conditions which necessitate the maintenance, defence, and independence of disconnected individual nationalities. To be logical, it would necessitate the breaking down of all individual States, all individual race conglomerations, and the fusing of all human elements into one grand State of the world. Until that time arrives there must of necessity be localised interests governed by the same local general conditions which maintain separate nationalities. All the social organisations of the State, such as Railways, Roads, Bridges, Harbours, Post and Telegraph, Schools, Defence and Protection, Poor Laws, etc., can only be logically maintained upon the admitted necessity of some common local national interest, having special concern for the general welfare of the particular nation; and these special local interests are so intertwined by so many bonds more precious than mere questions regarding *absolute cost of products in money*, that it seems absurd to say that the destruction or suffering of any of its members are locally only of equal concern to a corresponding evil in a foreign state similarly constituted. The necessary gravitation and concentration of interests and sympathies around home and fatherland are as natural as perspective in optics; the greatest density must be near the centre of—self, home and family—becoming weaker and weaker as the relative rings of friends or relations, club, townsmen, nation, race, are passed through to the thinner sympathies lying beyond, embracing humanity generally, where foreign races and states are bound in; and they themselves are related obversely to us in a similarly graduated series of interests and sympathies. It is this grand gravitation of human interests and sympathies which make possible ideas and forces, which make home, friend, and fatherland; and these—not nominal cost of products—are the great factors which determine the energies and welfare of any community. Commercial laws tend to destroy the heart of all ideas which centre in home and fatherland, and if the nation is to live, it must carefully guard against its decrepitating influence. Its shuttle seems just as ready to weave the shroud of a nation as to bind nations in bonds of broader sympathies.

Dominating Wants Determine Occupations and Necessarily Produce Inequalities in the Form of Services.

Hitherto in the writings of Social Reformers the greater part of their attention has been confined to the monopoly by the poor of the lands, houses, railways, and other instruments connected with the production, security and distribution of the necessary wants of human beings. It is generally assumed that there is abundance of primary satisfactions for each one if the aggregate products annually created were more equitably distributed. But if even the necessary primary satisfactions were annually produced in sufficient quantity for the wants of all, it would go to prove the curious and inexplicable circumstance that the present haphazard training and supply and demand of those who are engaged, or who are being trained to engage in the various divisions of labour, are in perfect harmony with conditions which combine to effect a result which might seem too formidable if undertaken by the most absolute regulations of intelligent prevision. The present supply of satisfactions is determined by the estimates or combined action of self-interested producers. It cannot be affirmed on the basis of *producers' self-interest*, that wants are produced with the sole idea of providing the highest quota of satisfactions to each individual; at best they favour the *minimum* supply, as self-interest is best rewarded by a keen demand involving high prices; a result which would not be attained if the *maximum* quota of satisfactions for each individual was created. Of course the absence of a perfect scheme of combined prevision among producing competitors, and the unforeseen variable effects springing from natural causes year by year, often produce abundance, or superfluity, or over-production, as it is termed; but this is a result not premeditated, and although favourable to consumers for the time being, it is a mere accident causing a fall in prices, and is likely to be followed by purposeful under-production during the succeeding period, in order to produce a straitened market with a corresponding rise in prices, and results in a certain reduction of the ideal quantity of satisfactions falling to the lot of each consumer of the poorer classes. But this tendency of *self-interested* producers, striving to produce *under* the necessary requirement, is just the very condition for involving the poor in the continual battle with poverty and want;* and all that can be said in favour of self-interest, is that hitherto there has been no better method devised which would so effectually serve the *majority* of human beings.

Is it to be wondered, then, that the *less fit*—happily a minority—in the struggle for existence should at times cruelly feel pinching want, when upon them must fall the evil of the barely sufficing aggregate or scarcity, the ideal creation which the self-interested producer strives for?

It has been shown that the supply of wants is at present alone roughly predetermined by the self-interested calculations of producers, and that their aim is to extend the field of production as far as they can in safety to themselves; and that means as near an approach to a full supply as will ensure good prices, involving a tight market, or scarcity. Consumers who desire abundance do not determine the forthcoming supplies. Producers' interests, therefore, are antagonistic to any social ideal which would bring the highest quota of necessary satisfactions easily within the reach of all men. Therefore, so long as producers' self-interest rules supreme in the creation of necessary products, so long must we expect the periodic suffering and pinching of the lower stratum of the working classes.

Food, clothing, houses, railways, steamboats, and the various machines of production, are almost wholly regulated in the interests of producers; competition alone preventing this interest from working in too great antagonism to the interests of *consumers*. Nearly all breadwinners, therefore, in detail defeat to some extent their own ultimate interests as general consumers, by regulating the production of supplies upon a principle which is inimical to their interests as consumers. Nor is this the only evil. All wages—breadwinners must produce, or serve to produce, before they can earn the right to share or consume the fruits of production. But the *number of those actually employed* depend almost wholly upon the *self-interest* of the *large capitalist producers.*

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* Bastiat even is forced to admit that "antagonistic desires cannot at one and the same time coincide with the general good." . . . . . "As a purchaser he desires abundance; as a seller scarcity . . the wishes and desires of the *consumers* are those which are in harmony with public interest."

It is not the interest of large capitalist producers to provide the full quota of wage-earning employment to *all* breadwinners. The larger the number of fully employed labourers the keener is the demand for products, and indirectly this may have some influence upon certain producers. But this indirect consideration is too feeble to interest producers in any scheme for the general good which might be directed to ensure full employment to *all* breadwinners. It is manifest, therefore, that in the present scheme of the division of labour there are two ugly defects. *First*—There is no interest intelligently organised to train and determine the occupations of the future breadwinners according to natural proportions. *Second*—The only existing agencies which determine the extent of employment are guided by a principle which has for its object neither the supply of the highest quota of satisfaction to consumers, nor the more needful provision for securing employment to all breadwinners. In the latter case competition, instead of befriending the wage-earner and dependants as consumers, operates all the more harshly upon the larger number who are handicapped in the race by aimless training, or no training, for the nature of services that might possibly be otherwise open to some of them.

UTOPIAN SCHEMES OF SOCIALISTS.

It is not a matter for surprise, therefore, that the mass of wage-earners should readily sympathise with every vague Utopian scheme of the Socialists, which holds out, however faultily, some promise or plan for dealing more effectually with the root difficulties which affect them most nearly, viz., security of employment; protection from over competition; shorter hours labour with more adequate remuneration; redistribution of wealth, etc., etc.

But it is needless to point out that before the redistribution of the aggregate of all forms of existing wealth of exchange (so-called) can be dealt with, it must be clear that this wealth consists of such forms as might effectually satisfy all the primary wants and comfort of human beings. That existing *wealth in exchange*, even if equally distributed, would fulfil this most necessary provision, is a pure assumption.

It has already been shown that a great part of the existing nominal wealth of exchange, largely owned by the rich, consists of the mere *tools* and *instruments* of production, and that the real wealth, appropriated as consumable wealth or primary satisfaction, is already more widely and evenly distributed than is generally supposed. Even under the most thorough Socialistic scheme this form of wealth would be far less generally distributed than at present; for, according to such a scheme, it would be wholly reserved in the hands of the Executive Government. It is utterly misleading to reckon upon the existing wealth of capitalists as a source for raising the quota of the real consumable and primary satisfactions. The only distribution possible in this respect would be the empty idea of part ownership. It is the increase to necessary current productions *designed for actual consumption* — material satisfactions — which alone can raise the average standard of primary satisfactions, and so dispose of material want, or poverty and distress. The question therefore arises. Suppose that such a scheme were practicable, would the producing energies of men be greater and more effective than under the Scheme of Competition, Liberty, Right of Inheritance, Property Right, or Individualism, as it is called? To be more effective in one essential it must utterly fail in the other. The workers must be trained and allocated to specific occupations in strict conformity to the amount and nature of the labour actually required to produce the primary satisfactions and comforts desired. Training for every specific occupation requires considerable time; but for the occupations of skill a large amount of time must be consumed in acquiring the necessary training, irrespective of question with regard to the unequal distribution of capacity.

Now on the basis of equality it may be easy to divide products; that, according to actual needs is simple enough, involving no insuperable difficulty. But what about the allocation to different employment? How can the easy, the refined, and the skilled occupations be allocated on any scheme of equality? The majority must, as heretofore, sweat at the hard and dirty forms of labour. But what power, or what plan can be devised which will enable any elective executive to doom once and for ever the majority of learners and workers to the hard and irksome occupations, and to fix the minority in the refined, the easy, and skilled services?

Suppose it were for a time instituted, how long would the unfortunate majority be content to submit to their lot before an irresistible cry for *redistribution of occupations* arose; and if it arose, where is the force stronger than the majority of freemen to prevent the breakdown of the social organisation necessary to produce the supply of primary satisfactions according to individual needs? What compensation can be given to the masses toiling in the more wearisome occupations? Extra allowance of satisfactions cannot be thought of, for that would destroy the coveted ideal of equality in the distribution of satisfactions according to needs. Shorter hours cannot be allowed without trenching upon equality of leisure.

The unequal distribution of natural capacity, and the time necessary to acquire knowledge of more than one technical branch of skilled employment, make it impossible to share in turn for a time all possible forms of labour. In short, the practical difficulties standing in the way of *equality* in the *allocation of employments* appear to be insuperable, and would most certainly, if there were no other objection, destroy any social organisation on a *large scale* which had been courageous enough to attempt it. Reference to simple communities—as in America—following agricultural pursuits mainly, and not of themselves fulfilling for themselves the whole round of human wants, are utterly misleading. Such small communities are composed of a peculiar select class, who voluntarily bind themselves to a more or less ascetic life, and all such partial attempts tend to perish from lack of internal vitality. With a large mixed body of men embracing all occupations and endowed with ordinary passions and desires, the results would be chaotic and disastrous in the extreme.

One effect, terrible to contemplate, would seem to be inevitable, viz., that the indiscriminate distribution of products among all men would destroy the major source of savings at present so largely devoted to the creation and maintenance of the powerful and costly auxiliary aids to human labour; and the slight individual gain per head in material satisfaction would only be of a very temporary character, for it would soon be lost by the new impulse given to the improvident to rapidly increase their numbers.

WHAT WOULD BE THE PROBABLE EFFECT UPON SOCIAL WELL-BEING IF THE MAJOR SOURCE OF SAVINGS WERE DESTROYED?

In another place it has been indicated that the mere "two-hands," or the unaided labour of man, would not only fail to produce the average comforts and luxuries now enjoyed by nearly all classes of men, but more calamitous still—they would fail to produce the *prime necessaries* of life in sufficient quantity to maintain the lives of the existing population. Defects in the existing scheme of civilisation—some of which seem to be ineradicable—may be truly charged yearly with the destruction of thousands of valuable lives, but were the present major source of savings dissipated or destroyed by equality in share of earnings—either by lowering the powers of production, or by *slightly raising temporarily* the average amount of satisfactions *consumed or enjoyed*—the new conditions (equality of earnings) would be a blight and a curse; for while the existing defects in distribution may be the cause of the misery and destruction of thousands of valuable lives, the *equality* scheme would certainly entail the misery and destruction of millions now living in a state of comparative comfort.

Many who fail to ponder upon these root difficulties may exclaim:—How can you explain this paradox? Why should the fairer distribution of wealth (that according to actual, individual needs, without regard to inequalities of natural powers, capacities or . inheritance,)—raising the average comfort of the majority, and lowering the superfluous and luxurious satisfactions of the minority—be productive of such disaster? The answer is plain enough. The power to effect large savings or to create the more costly auxiliaries of labour depends mainly upon the existence of specially favourable conditions.

1. The desire to accumulate or save can only become strong enough to be effective when the stronger desires for primary satisfactions are appeased.

2. Savings or accumulations, therefore, can never be produced by labourers or others whose earnings do not exceed the supply necessary to satisfy the three primary wants. The majority of breadwinners are always in this hand to mouth condition, and rarely of themselves are able to contribute to the maintenance and increase of machines and instruments to serve as auxiliaries of production to future labour. They, however, in their social relations more than contribute the average share of the future surplus workers whose efforts must be proportionately supplemented by capital and power-multiplying instruments, if they are to enjoy the same or a further improved condition.

Those workers whose earnings are sufficient to provide comforts beyond the limits of bare prime necessaries, may, however, by self-denial in the satisfactions of *comforts*, lay by a small store of savings, which in time may swell into such valuable auxiliaries to earnings, that the self-denial in *comforts* hitherto may be rewarded in the greater satisfaction of comforts in the future, and even add considerably to the store of wealth which may be converted into the more permanent capitalised auxiliary instruments of power which will benefit the generations coming after them.

Those, however, who contribute most largely to the creation of the permanent instruments which add unknown power to the efforts of hand labour, are chiefly those who either have inherited these or similar creations from their ancestors, or who by extraordinary energy, skill or self-denial, or all together, in the earlier part of their lives, are now enabled, after satisfying the three primary wants and comforts, to indulge the prevailing passion of comfortable people, *i.e.*, the accumulation of wealth or power over wealth. This passion in itself is at this stage undoubtedly a personal luxury; but, unlike the luxuries which are directed to greater *personal consumption*, it is fortunately directed to that form of immaterial enjoyment which springs from the knowledge that the owner possesses the power to direct the mode, or secure the best conditions in which wealth may be further employed. Fortunately for the world at large, self-interest at this stage converts into a virtue what otherwise would be a vice: for the passion to further secure the luxury of power over wealth, and to augment it, restricts personal indulgence in further consuming the *material fruits of labour and the material gratuitous stores of nature*, and runs parallel with that course which favours increased production relative to numbers, involving the improvement of the social and economic condition of all labourers; *i.e.*, the wealthy man or industrial chief does not, or cannot, increase his own personal consumption of the *material* fruits of labour, skill, enterprise and the gratuitous gifts of nature beyond a moderate standard: the unconsumed material surplus—by passion, self-interest and even the better motives—is necessarily devoted to multiplying and sustaining the inanimate, costly, and powerful permanent aids to human productive power, which alone distinguishes civilised populous communities from those of the miserable and bare-handed savage, whose command of a continent of the richest land upon the globe is too feeble to support in comfort a few insignificant wandering tribes.

ANTERIOR SAVINGS THE TRUE SOURCE OF CAPITAL INVESTED IN THE CREATION AND DISTRIBUTION OF NECESSARY SATISFACTIONS.

Capital invested in land, railways, ships, canals, mines, mills, etc., and all labour-aiding machines and instruments devoted to the production and distribution of man's satisfactions, are the fruits of that portion of the products of *anterior labour* saved from the actual earners' consumption, and devoted or transformed into permanent and powerful skilled auxiliaries of *present labour*; and consequently it is an error to assume, as many do, that such forms of capital are the fruits of the major part of *anterior labour* already absorbed in current personal consumption.

That is—the capital in machines and instruments now devoted to production and distribution is derived from the *saved* products of anterior labour engaged in production, and not from the efforts of such labour necessarily absorbed in sustaining the said labourers. It is true in one sense that all products, whether saved, transformed, or consumed, are obtained by means of labour; but it is equally true that only a minor portion of the products of labour is yearly devoted to fixed instruments to act as auxiliaries to future labour; and this minor portion is *wholly* derived from products of labour and skill *saved* from immediate destruction or consumption, and skilfully applied or directed to the creation of fresh auxiliaries to labour.

It follows from these considerations that existing capital so applied is *wholly* derived from *providential savings and skill,* and that only labourers who have contributed to these savings—with their natural representatives (inheritance)—have any real claim to a corresponding right to its *present* utilities and fruits.

Savings may be effected in various ways. They may be effected by greater industry: by the devotion of former savings to appliances aiding production: by increase of skill: by curtailing enjoyment in the consumption of satisfactions beyond *primary needs* or by a combination of all these: thus:—

Let I = Industry or energy expended.
K = Skill.
A = Skilled appliances or aids, the fruit of anterior providential savings.
C = Actual current consumption.
S = Current savings.

Then $I\,K\,A - C = S$ or current savings.

So long as C or current consumption absorbs all the powers of I K A there can be no savings. When C exceeds I K A, debt, pauperism, crime, or death, may be the result.

When I K A exceeds C there must be prosperity and augmentation of the powers for producing more wealth.

The maximum savings are effected when I K A are at the maximum (^{m}) and C is at the minimum (^{u}) necessary to secure the satisfaction of primary wants: thus:—

$I^{m}\,K^{m}\,A^{m} - C^{u} =$ Maximum of savings.

But if the power of C to waste, destroy, or consume the results of I K A be indefinitely increased say to (^{x}) power there may be no balance or savings: thus:—

$I^{m}\,K^{m}\,A^{m} - C^{x} = 0$ Savings.

That is, the stage of no savings is produced by the absorption or consumption of a very great amount of luxurious satisfactions.

But this state of *no savings*, or the minimum of savings, may be and is more frequently the result of the diminished (^{n}) powers of I K A with the minimum of C, or minimum stage.

$I^n K^n A^n - C^n = O$ Savings.

We have here four or five important conditions affecting the appropriation of the fruits of industry, skill, and skilled auxiliary appliances and aids.

(1) $I^m K^m A^m - C^n =$ Minimum of satisfactions and maximum of savings.

$I^n K^n A^m - C^n$ (2) or $I^m K^m A^m - C^x =$ Maximum of satisfactions and no savings.

(3) $I^m K^m A^n - C^n =$ Minimum of satisfactions and increase of savings.

$$\left.\begin{array}{l}(4)\quad I^m K^m A^n - C^m = \\ (5)\quad I^n K^u A^n - C^n = \end{array}\right\}\text{No savings, and poverty.}$$

The first group is composed almost entirely of rich capitalists possessing skill, energy, and living moderately or abstemiously.

The second group is composed of rich capitalists possessing skill and energy, but living in extravagance.

The third group is composed of skilled minds and hands, middlemen, professional men, and better class of skilled labourers living moderately within their means.

The fourth group, the same as the last, but living up to their means, or lacking skill or energy.

The fifth group is composed of unskilled workmen lacking industry or lacking employment, or skilled workmen lacking energy or employment, or improvident in their manner of living.

Whatever defects spring from riches there is this to be said in its favour: that by passion for accumulation or savings of its owners it secures the necessary fund to invest in the expensive tools and instruments of production, without which the primary wants of the existing population could not be supplied. The desire to sacrifice present ease to future benefit is confined to the few, and if the products were generally distributed in equal proportion they would be almost entirely lost by slightly raising for the moment the average consumption of satisfactions; and this slight advantage would soon be dissipated by the impulse which it would give to the masses of improvident persons—in heightening the marriage rate, and causing a rapid increase of population or mouths to be fed.

FALLACIES OF THE SINGLE TAX PANACEA.

Mr. Henry George's name among modern writers stands pre-eminent in the advocacy of the abolition of the existing modes of levying taxes mainly derived from land and property, luxuries, and foreign products, and substituting for the same a direct tax upon the value of the land,* minus such *tangible* artificial additions to its value that may be truly estimated as *improvements* solely created by the labour or services of man. Waiving the serious objection at the threshold of this proposal, viz., the difficulty—nay the impossibility—of justly determining the proportional values of the *land* and the *improvements* added to it by *man's services*. Let us examine it fairly in the light of the various CANONS OF TAXATION which Mr. George himself quotes with approval: Thus p. 63 (People's Edition) "Progress and Poverty," he affirms:—

"The best tax by which public revenues can be raised is evidently that which will closest conform to the following conditions:—

"1. That it bear as lightly as possible upon production so at least to check the increases of the general fund from which taxes must be paid and the community maintained.

"2. That it be *easily and cheaply collected and falls as directly* upon the ultimate taxpayers, so as to take from the people as little as possible in addition to what it yields the Government.

"3. That it be certain, so as to give the least opportunity for tyranny and corruption on the part of officials and the least *temptation to law-breaking* and evasion on the part of the taxpayers.

"4. That it *bear equally*, so as to give no citizen an advantage or put any at a disadvantage as compared with others."

THE EFFECT OF THE SINGLE LAND TAX UPON PRODUCTION.

Mr. George asserts without the slightest attempt to show by argument or demonstration that "Taxes on the value of land not only do not check production, as do most other taxes, but they tend to increase production by destroying speculative rent." This, certainly, is one of the most absurd and fallacious assumptions that could be made, and yet, without reason or argument, Mr. George supposes that we can at once build upon this rotten foundation without question or hesitation. He evidently thinks that different *names* for the same thing have some occult power to alter the inevitable effects due to the thing *per se*, and not to the name applied to it. This is the fault of all visionary theorists. Let us brush away the thimble-rig of words and terms, and come at once to plain practical issues. No person can become a successful primary producer among other primary producer-competitors, unless he possesses the necessary capital and speculative skill. There is no business so uncertain in its results as farming, both as regards total income and total expenditure. More especially do these uncertainties apply to the enterprising farmer, who ventures into the speculation of entering upon virgin bush land with the view of earning a living for himself and his family ultimately from the profits derived from the sales of cultivated *products*. This profit consists entirely of the margin which the aggregate of his yearly *revenue* from sale of products shows above the aggregate of his yearly *expenditure*. It is the *amount* of the several items of *revenue* and *expenditure* which determines his *profit* or his *loss*, and not the specific nature of the various items of *revenue* and *expenditure*.

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* That means in practice a tax upon local products in lieu of a tax upon foreign products.

All items of expense, including profit, must come out of products, or he will speedily become bankrupt and cease to be a producer. Consequently, all products embody *all charges*, whether interest, mortgage, rent, tax, wages, other working expenses, and cost of farmer's own services as director and speculator, viz., *profit*.

Rent Versus Single Tax.

Rent adjusts itself to the producing capabilities of the land. But a single national tax upon the land would be likely to prove a more formidable check to the cultivation of the soil or local production than the most heavy form of rent.

Rent is admittedly determined by the average margin left from the *sale* of products, after giving the working expenses of the farm *plus* the minimum profit to the working farmer. It cannot seriously affect production without destroying itself, and hence it must accommodate itself to the said margin, even though it should fall to rent zero. The latter stage, if reached, might check production, but so long as any margin remained production would be determined by the capabilities of the land and the enterprise and skill of the farmer. There is, therefore, no predetermined charge *fixed in character*, forming a charge on production in the shape of rent. On the contrary, it fluctuates in time in correspondence with the revenue yielded from the sale of its products. Rent rising, with relative improvement, either in price of products or with relative decrease in the cost of working the farm, due to improved machines or methods of cultivation; rent falling with the reverse of these conditions. On the whole, therefore, rent, interest, mortgage, and working farmers' share of profit resolve themselves into mere sub-divisions of the total profit due to farm speculations drawn from sale of products, the balance of sale of products being absorbed by wages and miscellaneous expenses of working, all entirely governed by, and not exceeding, the total revenue of products, the amount of which is regulated by the local competition of similar goods that may be conveyed in any market from foreign as well as local sources. It is absurd, therefore, to suppose that a *tax* upon land does not enter into the ultimate cost of the product just as surely as the items of charge known under the names of interest, mortgage, wages of farm servants, profit of farmer; for as soon as the prices governed by local and foreign competition fail to cover *all* the items of expenditure and minimum of profit, so soon will a *check* appear to Production, so far as the land which is so effected is concerned. There is no trick of words about this result. Every practical farmer knows it too well, although he may not understand the word-splitting and theory-chopping of some speculative Economists. Thus, with average energy and skill, if the produce per year of a grain farm at current prices only covers the minimum of wages and ordinary working expenses, and minimum of profit to farmer by £50, then such farm could only yield that sum for all other charges, whether tax, rent, mortgage, or interest. It is immaterial to the farmer whether the charges be distributed over all these items thus:—

	£	s.
Tax	12	10
Rent	12	10
Mortgage	12	10
Interest	12	10
Total	£50	0

Or simply thus:—

	£
Tax	50
Rent	*nil*
Mortgage	*nil*
Interest	*nil*
Total	£50

The effect upon production, producer, and consumer would be exactly the same. If this sum of £50 could be disposed of altogether it would be possible for the farmer to reduce to that extent the price of products to consumer, but the consumer must necessarily pay for it so long as it remains a charge either as tax, rent, interest, or mortgage. It is the *amount* remaining as a *charge* that concerns the producer and the consumer, and not the *nature* or *name* of the item forming the said charge.

So long, therefore, as foreign products are not artificially excluded from local markets the consumer is perfectly secure against the monopolists of local rents raising the price of products by arbitrary increases to rent.

But a very different conclusion must be arrived at if rental and other charges, such as interest or mortgage, are abolished, and merged in the shape of a single tax upon land. In the first place, if we abolish all burdens on land in the shape of rent or mortgage—How are we to do so? In these colonies at least, the right to the rent of land has been acquired by honest purchase. Even now the State in Tasmania derived (in the year 1888) a revenue of £77,504 from rental and fresh sales of land; a sum equivalent to 19·09 or nearly 20 per cent. of the total yearly taxation. In the 10 years ending 1888 the State derived a revenue of £646,497 from the same source: and yet after taking from honest purchasers this original value of the land, Mr. Henry George and his followers would urge upon the State to retain the original purchasers' money, and wrest from them all rights in land thus acquired without compensation. Such a proceeding would be revolting to all who possess any remaining trace of the sense of honour. The hypocrisy of glossing over such wholesale robbery by any fine-sounding phrase only shows how far the modern robber has fallen from his ancient prototype, who, at least, had the courage to consent to an appropriate name for his violence and dishonesty. We have no representatives of feudal lords in these colonies, and if we had, the proprietors of the land for the time being are as much and as little their representatives as any other capitalist; for every year a considerable portion of the land changes hands by fair purchase, and there are now few owners of land who can trace their land to the State by purchase or grant, who have not parted with it on fair terms of purchase to those who amassed wealth from other sources of wealth and enterprise. The condition of society, if it is to be improved, cannot be ameliorated by State robbery or violence. There is, therefore, only one honourable course for the Single Tax theorists to adopt, viz., to compensate the existing owners for the loss of their rightly acquired property. This course would involve capitalising the land. Now, supposing this to be done, and that we made some profit by borrowing, say, at 3½ per cent. (allowing that the revolutionary scheme has not the immediate effect of destroying our credit), what would be the sum to provide for?

The last estimate of private property is stated to be £21,386,848, and it will be near enough the mark to state that 40 per cent. of this value refers to land *minus* improvements. This represents a capital sum of £8,554,739. Even if we raised this sum at 3½ per cent. par, it would increase our existing charge for interest on debt by £299,415.

Single Tax fixed in character determined by the needs for public expenditure without regard to the capabilities of the land or to its power to sustain the burden so imposed.

But if we are to meet the demands of public expenditure we must concentrate all the other modes of raising revenue from taxes and land sales in one single tax or burden upon the land. At present the revenue raised in this way in Tasmania amounts to £455,027 *per year*. If to this we add the fresh charge for land transfer to the State, the tax upon land would be necessarily raised to £754,443. The present value of the annual rateable value, *minus* improvements, is estimated to be £440,800. It would therefore follow that the direct burden upon land would be raised £313,643 *per year*, or 71 per cent. above the burden now imposed upon it by way of rent; or if we take the land and improvements, it would mean an increase of 28·45 *per cent.* on land and its improvements above the burden at present imposed due to rental. It is true there would be some set-off to this in the abolition of other forms of taxation, at present mainly derived from the luxurious consumption of spirits and tobacco, etc., averaging £2 16s. 2d. *per head* per year, or £6 5s. 8d. per *breadwinner*, £11 4s. 8d. per family of four persons, or £14 13s. 10d. per *household*.

But it must be borne in mind that at present the taxes actually paid by any one individual, by an inevitable law, is adjusted to the means of the individual. For example, the large part of the necessaries of a poor man is not taxed—bread, meat, vegetables, and such like—and even on the taxable articles the amount of tax is proportionate to the amount the individual is enabled to expend upon taxable articles, principally drink and tobacco. A non-drinker and non-tobacco smoker, therefore, at his own pleasure, escapes the greater part of the State tax. In this way any person, by the present mode of taxes, need in case of distress, pay only a very small portion of his income in taxes.

But in the case of a single tax upon land (ground rent) the poor man in a four-roomed weatherboard hut might have to pay the same amount of tax as his rich neighbour in a fine house. Thus take the following possible cases:—

	Capital Value		Annual Rent of House	The same as affected by Land Tax		Annual Rent of House	In-crease.	Per Cent.
	Land	House		Land	House			
	£	£	£	£	£	£	£	
A	200	2,000	110	342	2,000	117	7	6·3
B	200	1,500	85	342	1,500	92	7	8·2
C	200	1,200	70	342	1,200	77	7	10·
D	200	1,000	60	342	1,000	67	7	11·6
	200	500	85	342	500	42	7	20·
F	200	300	25	342	300	32	7	28·
G	200	200	20	342	200	27	7	35·

Land 40ft. frontage on street same Block.

Thus, if the total rental be a fair index to the means of each tenant, the table shows that the effect of the single tax in adding £7 alike to rich and poor, would be only a relative tax to the rich (*a*) of 6 per cent., while to the poor (*g*) it would be equal to an increase of 35 per cent. Thus it would appear that the single tax would violate the most valuable canon of taxation, —8, (Adam Smith.) "The subjects of every State ought to contribute towards the support of the Government as nearly as possible in proportion to their respective abilities." When we consider also that if the farmer is able to add the increased burden of 28·45 per cent. to his products (and if he fails by foreign competition to do this, he can no longer carry on the farming industry in Tasmania), we must also add 28·45 per cent. to all products of Tasmania which the poor man's family consumes, we perceive at once that *the single tax scheme would mainly fall with cruel severity upon the poor man*, and thus the scheme instead of a boon would be a curse to him, and perhaps check half or most of our great producing industries. If our principal industries were checked it would operate at once in throwing a great part of the population out of employment. Even if it only curtailed a labourer's employment by 10 per cent. it would have the effect of reducing his wages (at 6s. per day) by 0·92 pence, nearly a 1d. per hour: while if the whole land rental were directly distributed among workmen yearly it would only have the effect of raising their wages by 0·679*d*. or only *2-3rds of a penny per hour*.

As regards the supposed effect of decreasing the cost of collecting revenue, and preventing fraud, it would have the opposite effect. Collection by Customs in Tasmania only represents 2·8 *per cent.* of the total revenue collected, as against a charge of 5 *per cent.* for collection of Real Estate Duties and Police Rate.

Thus the whole of the canons of taxation cited by Mr. George would be violated by any single tax proposal.

FURTHER OBSERVATIONS UPON THE FISHES AND FISHING INDUSTRIES OF TASMANIA, TOGETHER WITH A REVISED LIST OF INDIGENOUS SPECIES.

By Robt. M. Johnston, F.L.S.

It is now about eight years since my first Catalogue of the Fishes of Tasmania was presented by me to the members of this Society. Since that time I have occasionally published an account of other species not embraced in my original list. Messrs. A. Morton, F.L.S., and Saville-Kent, F.L.S., have also made two or three interesting contributions, and have added considerably to our knowledge of the indigenous fishes of the island. In this way the 188 species then known have increased to 214 species. As it is desirable that a fresh catalogue should be prepared, embracing all the species known at the present time, I have much pleasure in submitting the following additional observations regarding our fishes and fishing industries, together with a list of the principal edible fishes, and a complete classified list of all the fishes known to me at the present time.

The Tasmanian student has now also the great advantage of reference to the splendid "Catalogue of Australian Fishes," prepared by the Hon. William Macleay, to whom the author acknowledges himself greatly indebted for valuable guidance and information.

FISHES.

The known sea and inland fishes of Tasmania, including the eight species of European fresh-water fishes successfully acclimatised, number 214 species. These are generally grouped by naturalists under 4 sub-classes, 65 families, and 146 genera. About one-third of the number stated may be considered good edible fish, although only about 21 species are caught in sufficient number to form a market supply. The following are the local names of those found in greatest abundance, the first six alone forming articles of export*:—The Hobart Trumpeter, Perch *(Chilodactylus)*, Snotgall Trevally, Barracouta, Kingfish, Conger Eel, Native Salmon,

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* For further particulars regarding Natural History and Classification, see Report of the Tasmanian Fisheries Commission, 152 pp., 1882; and General and Critical Observations on the Fishes of Tasmania, with a Classified Catalogue of all the Known Species, by the Author (Proc. Roy. Soc. of Tasmania, 1882).

Bastard Trumpeter, Red Perch, Rock Gurnet, Flathead, Horse Mackerel, Sea Mullet, Rock Cod, Ling, Flounder, Sole, Garfish, Common Eel.

The first of these, the Hobart Trumpeter, is undoubtedly the king of Tasmanian Fishes, and is generally esteemed as the finest of the Australian edible fishes. It commands a high price and ready sale in the local market as well as in the neighbouring colonies; but, unfortunately, although captured in considerable numbers all the year round, it is very limited in its distribution, being confined to certain coral reefs or banks 10 to 70 fathoms deep fringing the southern coasts of Tasmania between Granville Harbour in the west and Seymour in the east.

The Barracouta, Kingfish, and Rock Cod appear periodically in such vast numbers that frequently the supply is greatly in excess of local demand. Owing to the absence of proper fish-curing establishments, large quantities have, at times, been known to be wasted or merely utilised as manure.

It is known also that large schools of Sand-smelts, Sprats and Anchovies appear upon our coasts at regular seasons, but, for the reasons already mentioned, and because the fishermen lack the proper appliances in the shape of *Pilchard Seine* nets, no attempt hitherto has been made to open up an industry in this particular direction.

Trawl-nets have been tried on the coast, but without good result. Either the class of bottom fish is absent in our waters, or the proper grounds have yet to be discovered suited for this mode of capture.

Besides the fishes proper, the fishing industry is largely dependent upon the capture of a fine species of Crayfish *(Palinurus Edwardsii)*, which often weighs, when mature, from 6 to 7lbs. It is estimated that there are over 280 tons of this highly prized Crustacean brought to market yearly, including those exported to Victoria and New South Wales, but excluding those used for baiting purposes and those captured by Victorian boats. There is also a small Prawn taken in considerable quantities during the season in the River Tamar. They abound all round our coasts, but little attention has been devoted to them anywhere on the coast beyond the River Tamar.

Of Molluscs there is only one of any importance,—viz., the Common Mud Oyster. Although not now abundant, it is estimated by competent authorities that about 20 years ago the various beds yielded about 44,000 bags, or 22,000,000 oysters per year.

The destruction of these once prolific Oyster beds have engaged much attention. Although attributed generally to reckless unrestricted dredging, continued until the greater number of the beds were wholly destroyed, it is believed by some that natural causes were operating concurrently with the causes alleged. Attempts have recently been made to extend the cultivation of the Oyster in the old habitats with great promise of success. Natural conditions again seem to be working round in favour of the development of the Oyster. The prolific fall of Spat during the last two or three years in the natural beds at Cole's Bay and Little Swanport, and their rapid growth there, promise well for the future of the new centres where artificial beds are laid down, at Spring Bay and elsewhere.

The following is a more extended List of the Edible Fishes brought to market in more or less abundance, according to the kind and season:—

LIST OF THE PRINCIPAL EDIBLE FISHES IN TASMANIAN WATERS.

[a] Abundant all the year round.	[b] Abundant during the season.
[c] Common all the year round.	[d] Common during the season.
[e] Not uncommon ditto.	[f] Not uncommon ditto.

PERCIDÆ (Perch Family).

Anthias rasor	*Red Perch*[d]	Season, winter.
Lates colonorum	*Brackish Water Perch*[a]	Confined to Anson's River.
Arripis truttaceus	*Native Salmon*[a]	Periodically enter estuaries in schools.

SPARIDÆ (Bream Family).

Girella tricuspidata	*Black Bream*[d]	Season, October to March. C. Australis enters brackish water lagoons and mouths of rivers for spawning purposes.
" simplex	*The Sweep*[d]	
Chrysophrys Australis	*Silver Bream*[d]	

CIRRHITIDÆ (Trumpeter Family).

Chilodactylus Allporti	*Carp*[d]	Season, January to March.
" macropterus	*Perch*[a]	Height of season (mature), April to August.
" vizonarius	*Magpie Perch*[f]	
Latris hecateia	*Trumpeter*[a]	The most excellent of all Tasmanian fish. Sometimes reaches a weight of 60lbs.
" Forsteri	Silver Bastard[b]	Abundant during season, January to March. Rivals the Real Trumpeter at this stage.
	Red Bastard[a]	Immature form; good, but not equal to mature form.
Mendosoma Allporti	*Real Bastard*[e]	

SCORPÆNIDÆ (Gurnet Family).

Sebastes percoides	*Rock Gurnet*[c]	Found on the outer reefs.

TRICHIURIDÆ (Barracouta Family).

Lepidopus caudatus	*Frostfish*[f]	Caught at odd times—winter.
Thyrsites atun	*Barracouta*[b]	Important food fish. Caught in vast numbers, November to August.
" Solandri	*Kingfish*[b]	Season, December to June. Come and go in vast numbers, but disappear in some years altogether.

CARANGIDÆ (Horse Mackerel Family).

Trachurus trachurus	*Horse Mackerel*[b]	Season, Jan. to April.
Caranx Georgianus	*Silver Trevally*[b]	Enter Tamar and other rivers, midwinter.
Seriola grandis	*Tasmanian Yellowtail*[b]	Abundant Northern Coast, March to April.
Neptonemus brama	*Snotgall*[b]	Season, March to April.
" dobula	*Mackerel Trevally*[b]	Ditto, entering estuaries in large schools.

CYTTIDÆ (Dory Family).

Cyttus Australis	*Bastard Dory*[d]	Enter estuaries in schools, but seldom captured.

TRACHINIDÆ (Whiting Family).

Uphritis Urvillii	*Sandy*[a]	Abundant in the River Jordan and East Coast rivers.
Sillago ciliata	*Whiting*[d]	One of the most delicious fishes in our estuaries.

COTTIDÆ (Flathead Family).

Platycephalus Bassensis	*Common Flathead*[a]	A very fine fish, though repulsive looking. Abundant on sandy bottoms.

ATHERINIDÆ (Silver Belly Family).

Atherina presbyteroides " hepsetoides " hepsetus " microstoma " Tamarensis	*Silver Bellies*	These little fishes are found everywhere in vast shoals. Although seldom exceeding 5 inches long, they form a delicious article of food. No trouble is taken to capture them for market.

MUGILIDÆ (Mullet Family).

Mugil cephalotus	*Sand Mullet*[d]	Excellent fish. Found on the northern and eastern coasts.
Agonostoma Forsteri	*Estuary Mullet*[a]	Caught chiefly by hand-rod, in large numbers.

LABRIDÆ (Parrot Fish Family).

Cossyphus cerulæus	*Blue Head*[a]	Abundant, and although good food, it is not brought to market.

GADOPSIDÆ (Blackfish Family).

Gadospis marmoratus	*Freshwater Blackfish*[a]	An excellent fish, peculiar to our northern rivers.

GADIDÆ (Cod Family).

Pseudophycis barbatus	*Rock Cod*[a]	Excellent fish, well suited for smoking. Very numerous during winter.

OPHIIDÆ (Ling Family).

Genypterus blacodes	*The Ling*[e]	Very fine fish.

PLEURONECTIDÆ (Flounder Family).

Rhombsolea monopus	*Flounder*[a]	Excellent table fish.
Amnotretis rostratus	*Sole*[e]	Abundant in some estuaries.

SALMONIDÆ (Salmon Family).

Retropinna Richardsoni	*Whitebait or Smelt*	Enters estuaries in large shoals. Though only 3 to 4 inches long, they are very delicious.

Salmo salar	The Salmon	These valuable fishes have all been successfully introduced from the United Kingdom. The three last species are very abundant now in our rivers and seas. The Brown Trout sometimes reaches a weight of 32lbs.
" trutta	Sea Trout[b]	
" fario, v. Ansonii	Brown Trout[b]	
" fontinalis	American Trout[b]	

Haplochitonidæ (Grayling Family).

Prototroctes maræna	*Cucumber Mullet*[b] *or Grayling*	This fine little fish is the most delicious of our freshwater fish. It is found abundantly in the Mersey and northern and western rivers. Affords excellent sport to anglers

Galaxidæ (Jolly-tail Family).

Galaxias truttaceus	*Spotted Trout*[a]	Small fish, very abundant in all our streams Excellent for the table and caught readily by rod and line
" attenuatus	*Jolly Tail*[a]	
" auratus	*Golden Trout*[a]	Largest form, Lake Sorell.

Scombresocidæ (Garfish Family).

Hemirhamphus intermedius	*Garfish*[b]	Excellent fish for the breakfast table. Season, April-October.

Clupeidæ (Herring Family).

Engraulis encrasicholus	*Anchovy*[b]	Enters estuaries in large numbers during summer.
Clupea sprattus	*Sprat*[b]	Great shoals, Aug.-Nov.

No attempt has yet been made to utilise these valuable fishes, owing to the absence of appliances and to the lack of enterprise in the shape of fish-curing establishments.

Murænidæ (Eel Family).

Anguilla Australis	*Common Eel*[a]	No proper appliances exist for the capture of these valuable fish.
Conger vulgaris	*Conger*[a]	Valuable market fish, sometimes attains a weight of 40 lbs.

Sharks of various kinds are abundant, and although the smaller forms, such as Mustelus, are edible, they are not utilised as food.

Galeus canis (Dog Fish) is captured largely in certain localities, and the liver is boiled down for oil. The fishermen also largely use the flesh of "Gummies" and "Dog Fish" as bait for the deep-sea Trumpeter fishing.

The following is a classified synopsis of all the known Fishes of Tasmania, embracing 65 families, 146 genera, and 214 species:—

SYNOPSIS OF TASMANIAN FISHES OF ALL KINDS.

SUB-CLASS TELEOSTEI.

Family.	Genera.	Species.	Examples.
Percidæ	12	13	Red Perch, Native Salmon
Squamipinnes	1	1	Scorpis
Mullidæ	1	1	Red Mullet
Sparidæ	4	5	Bream, Schnapper
Hoplognathidæ	1	1	Hoplognathus
Cirrhitidæ	5	14	Carp, Perch, Trumpeter
Scorpænidæ	5	7	Gurnet, Soldier
Berycidæ	2	2	Nannegai
Kurtidæ	1	1	Pempheris
Sciænidæ	1	2	Maigre
Xiphiidæ	1	1	Swordfish
Trichiuridæ	2	4	Barracouta, Kingfish
Carangidæ	5	8	Horse Mackerel, Snotgall
Cyttidæ	2	2	Bastard Dory
Scombridæ	5	5	Mackerel, Pilotfish
Trachinidæ	5	6	Catfish, Whiting
Pediculati	1	2	Handfish
Cottidæ	3	5	Flathead, Flying Gurnard
Gobiidæ	2	2	Goby
Gobiesocidæ	1	1	Gobiesox
Blenniidæ	6	8	Blenny, Bully
Sphyrænidæ	2	2	Jack, Pike
Atherinidæ	2	6	Sand-smelt, Silver Belly
Mugilidæ	2	2	Mullet, Sand Mullet
Centriscidæ	1	1	Snipe, or Trumpet-fish
Gobiesocidæ	1	1	Crepidogaster
Lophotidæ	1	1	Lophotes
Trachypteridæ	2	2	Ribbon Fish
Pomacentridæ	1	1	Rock Perch
Labridæ	4	13	Blue Head Stranger, Parrot-fish
Gadopsidæ	1	1	Blackfish
Gadidæ	2	2	Rock Cod
Ophidiidæ	2	2	Ling
Macruridæ	2	2	Coryphæna
Pleuronectidæ	3	4	Sole, Flounder
Haplochitonidæ	2	2	Derwent Smelt, Freshwater Herring
Scopelidæ	1	1	Alepidosaurus
Salmonidæ	2	5	Salmon, Whitebait
Galaxidæ	1	5	Spotted Trout, Jolly-tail
Scombresocidæ	1	1	Garfish
Cyprinidæ	2	3	Carp, Tench
Gonorhynchidæ	1	1	Sand Eel
Clupeidæ	2	3	Anchovy, Sprat
Synbranchidæ	1	2	Chilobranchus
Muræindæ	4	5	Common Eel, Conger

Pegasidæ	1	1	Sea-dragon
Syngnathidæ	5	9	Pipefish, Sea-horse
Sclerodermi	2	12	Leather Jacket, Trunkfish
Gymnodontes	4	5	Toad Fish, Porcupine Fish
Total Teleostei (49)	121	186	

SUB-CLASS CHRONDROPTERYGII (Sharks and Rays).

SHARKS.

Chimæridæ	1	1	Elephant-fish
Carcharidæ	4	4	Blue Shark, Tope, Gummy
Lamnidæ	3	3	Porbeagle, Nurse, Thrasher
Notidanidæ	1	1	Tasmanian Blue Shark
Scyllidæ	3	4	Wobbigong
Cestracionidæ	1	1	Port Jackson Shark
Spinacidæ	1	2	Spiny Dog
Rhinidæ	1	1	Angel Shark
Pristiophoridæ	1	2	Sawfish

RAYS.

Rhinobatidæ	1	1	The Fiddler
Torpedinidæ	1	1	Electric Torpedo
Rajidæ	1	1	Thorn-back Skate
Trygonidæ	1	1	Stingaree
Myliobatidæ	1	1	Whip-tail Ray
Total Sharks and Rays	21	24	

SUB-CLASS CYCLOSTOMATA.

Petromyzontidæ	2	2	Lamprey, Pouched Lamprey

SUB-CLASS LEPTOCARDII.

Cirrostomi	1	1	Lancelet

SUMMARY.

Sub-class	Families.	Genera.	Species.
Teleostei	49	122	186
Chrondropterygii	14	21	24
Cyclostomata	1	2	2
Leptocardii	1	1	1
Grand Total	65	146	214

COMPLETE LIST OF TASMANIAN SPECIES.

SUB-CLASS. TELEOSTEI.

Fam. PERCIDÆ. (13.)

Perca fluviatilis, *Rondel.* (I.) English River Perch.

Callanthias Allporti, *Gunth.* (T.) Allport's Perch. D. 11 : 10. A. 3 : 10. L. lat. 46.

Enoplosus armatus. Old Wife. D. 7 : 1·14-15. A. 3·15.

Anthias rasor, *Rich.* (A.) Red Perch : Barber. D. 10 : 21. A. 3 : 9. L. lat. 54. L. tr. 4 : 18.

Microperca Tasmaniæ, *Johnston.* (A.) Native Perch. D. 8 : 1·7-8. A. 3·8 : V. 1·5. L. lat. 28-30 : L. tr. 12.

Lates colonorum, *Gunth.* (A.) Brackish Water Perch. D. 8 : 1-10. A. 3·8. L. lat. 55. L. tr. 8 : 21.

Oligorus gigas, *Owen.* (A.) Hapuka. (T.Z.) D. 11 : 12. A. 3·8.

Eurumetopos Johnstonii, *Morton.* (T.)

Apogon Guntheri, *Cast.* A. Brackish Water Perch. D. 7 : 1-9 : L. lat. 26. L. tr. 11-12.

Apogon Lemprieri, *Johnston.* (T.) D. 6 : 1-10. A. 2·9. L. lat. 27. L. tr. 3-10.

Arripis truttaceus, *Cuv.* and *Val.* (A.Z.) Native Salmon. D. 9 : 16-17. A. 3 : 10. L. lat. 48-52. L. tr. 6 : 12.

Histiopterus recurvirostris, *Rich.* (A). Boar Fish. D. 9 : 15. A. 3·10-11. P. 18. L. lat. 130.

Erythrichthys nitidus, *Rich.* (A.Z.) D. 9 : 3 : 1·9-10. A. 5·10. L. lat. 96. L. tr. 8 : 20.

Fam. SQUAMIPINNES. (1.)

Scorpis Georgianus, *Cuv.* and *Val.* (A.) D. 9 : 26. A. 3 : 27.

Fam. MULLIDÆ. (1.)

Upeneus porosus, *Cuv.* and *Val.* (A.Z.) Red Mullet. D. 8 : 1-8. A. 7. L. lat. 30.

SPARIDÆ. (5.)

Girella tricuspidata, *Cuv.* and *Val.* (A.) Black Bream. D. 15·11-13. A. 3·11-12. L. lat. 50. L. tr. 10-11 : 20-23.

Girella simplex, *Rich.* (A.) The Sweep. D. 14-15 : 12-13. A. 3·11-12. L. lat. 55. L. tr. 11-12 : 20-23.

Haplodactylus arctidens, *Rich.* (T.) Marbled Kelp Fish. D. 15-16 : 18-20 : A. 3·7 : P. $\frac{10-2}{6}$

Chrysophrys Australis, *Gunth.* (A.) Silver Bream. D. 11 : 10-11. A. 3·8. L. lat. 44-45 : L. tr. 5 : 13.

Pagrus unicolor, *Cuv.* and *Val.* (A.Z.) Schnapper. D. 12·10. A. 3·8. L. lat. 52. L. tr. 8 : 17.

Fam. HOPLOGNATHIDÆ. (1.)

Hoplognathus Conwayii, *Rich.* Hoplognathus. D. 12 : 12. A. 3·12.

Fam. CIRRHITIDÆ. (14.)

Chironemus marmoratus, *Gunth.* (A.) Large Kelp Fish. D. 14 : 1-18. A. 3·6. L. lat. 55.

Chilodactylus spectabilis, *Hutton.* (T.Z.) D. 17 : 26. A. 3·6. L. lat. 55.

Chilodactylus Allporti, *Gunth.* T. Carp. D. 17 : 25-28. A. 3·9. P. 8·6. L. lat. 55-56.

Chilodactylus carponemus, *Park.* (T.) Great Perch D. 17 : 31-32. A. 3·17-18. L. lat. 64.

Chilodactylus macropterus, *Rich.* (A.) Black Silver Perch. D. 17-18 : 25-28. A. 3·12-14. P. 9·6. L. lat. 55 : 4-5. L. tr. 6 : 13-15.

Chilodactylus nigripes? *Rich.* Black Silver Perch. D. 18 : 26. A. 3·10. L. lat. 61. 5 simple pectoral rays.

Chilodactylus nigricans, *Rich.* (A.) Black Butter Fish.

Chilodactylus vizonarius, *Kent.* (T.) Magpie Perch. D. 17 : 26-33. A. 3·9-10. L. lat. 63. 6 simple pectoral rays.

Nemadactylus concinnus? *Rich.* (T.) Magpie Perch. D. 17 : 28. A. 3·15. L. lat. 50.

Latris hecateia, *Rich.* (T.Z.) Trumpeter. D. 17 : 1·36-38. A. 3·28-30. P. 9·8-9. L. lat. 100.

Latris Forsteri, *Cast.* (A.) Bastard Trumpeter. D. 16 : 1·37-42. A. 3·33-36. P. 9-10·8-9. L. lat. 115-120.

Latris ciliaris, *Forst.* (A.Z.) Moki. D. 17 : 39. A. 3·32. L. lat. 84. P. 6.

Latris Mortoni? *Kent.* (T.) Morton's Trumpeter. (Teeth on Vomer. L. lat. 110.)

Mendosoma Allporti, *Johnston.* Real Bastard. D. 23 : 1·25-26. A. 3·18-19. P. 15-16. L. lat. 72-74.

Fam. SCORPÆNIDÆ. (7.)

Sebastes percoides, *Soland.* (A.Z.) Gurnet. D. 11 : 1·12. A. 3·5. L. lat. 60-65.

Scorpæna cruenta, *Soland.* (A.Z.) Little Gurnet. D. 11 : 1·10. A. 3·5. L. lat. 45?

Scorpæna panda, *Rich.* (A.Z.) D. 12 : 1·8. A. 3·5. L. lat. 67.

Holoxenus Guntheri, *Johnston.* (T.) Velvet Fish. D. 8 : 5·10. A. 3·9. C. 12-13. V. 1·5.

Holoxenus cutaneus, *Gunth.* (T.) D. 7 : 3·10. A. 9. C. 12. V. 1·5.

Pentaroge marmorata, *Cuv.* and *Val.* (A.) Soldier. B. 7. D. 12-13 : 10. A. 3·6.

Glyptauchen panduratus, *Rich.* (A.) D. 17 : 7. A. 3·6. V. 1·5.

Fam. BERYCIDÆ. (2.)

Beryx affinis, *Gunth.* A. Nannegai. D. 7 : 12. A 4 : 12-13. V. 1 : 7. L. lat. 41-43. L. tr. 6 : 12.

Trachichthys Macleayi, *Johnston.* D. 5 : 13. A. 3·10. V. 8. L. lat. 50. 13 scutes.

Fam. KURTIDÆ. (1.)

Pempheris macrolepis, *Macleay.* (A.) D. 4-5 : 12. A. 3·33-36.

Fam. SCIÆNIDÆ. (2.)

Sciæna antarctica, *Cast.* A. Victorian Kingfish. D. 9 : 1·27. A. 2·7. P. 17. L. lat. 68.

Sciæna aquila? *Lacep.* (E.) Maigre. D. 10 : 1·26-27. A. 2·7. L. lat. 53.

Fam. XIPHIIDÆ. (1.)

Histiophorus Herschelli, *Gray.* Swordfish.

Fam. TRICHIURIDÆ. (4.)

Lepidopus caudatus, *White.* Frostfish. D. 102-104. A. 24-25.

Thyrsites atun, *Cuv.* and *Val.* Barracouta. D. 20 : 1-10 : VI. A. 1·10 : VI.

Thyrsites micropus? *M'Coy.* D. 17 : 4·12 : VI. A. 2·11 : IV. VI. 1. P. 14.

Thyrsites Solandri, *Cuv.* and *Val.* Kingfish. D. 17-18 : 1·17-18 : I-II. A. 1·13-18 : II. P. 14-15.

Fam. CARANGIDÆ. (8.)

Trachurus trachurus, *Cuv.* and *Val.* (A.Z.) Horse Mackerel. D. 8 : 1·32-35. A. 2 : 1·25-29. L. lat. 75-86.

Caranx Georgianus, *Cuv.* and *Val.* (A.) Silver Trevally. D. 8 : 1·26-29. A. 2 : 1·22-24. L. lat. 20-25.

Seriola Lalandii, *Cuv.* and *Val.* (A.) Port Jackson Kingfish. D. 7 : 1·32-34. A. 2 : 1·20-21.

Seriola grandis, *Cast.* A. Tasmanian Yellow Tail. D. 6 : 1·32-35. A. 0 : 1·20. P. 21. V. 5.

Neptonemus brama, *Gunth.* (T.) Snotgall Trevally. D. 7 : 2·27-29. A. 2 : 1·22-23. L. lat. 88.

Neptonemus dobula, *Gunth.* (T.) Mackerel Trevally. D. 7 : 1·37-40. A. 2 : 1·23.

Neptonemus travale? *Cast.* (A.) Port Jackson Snotgall. D. 6 : 2 : 30. A. 2 : 2·21. L. lat. 93.

Temnodon saltator. *Bl.* Skipjack. D. 8 : 1·24-26. A. 1-2 : 1·26-28. L. lat. 90-100.

Fam. CYTTIDÆ. (2.)

Cyttus Australis, *Rich.* (A.Z.) Bastard Dory. B. 8. D. 8-9 : 1·28-29. A. 2·30. P. 11. V. 1·6.

Zeus Australis, *Rich.* (A.Z.) John Dory. D. 10 : 23. A. 4·22. V. 1·6.

Fam. SCOMBRIDÆ. (6.)

Gasterochisma melampus, *Rich.* (Z.) Butterfly Fish. B. 7. D. 17 : 1·10 : VI. V. 1·5. A. 2·10 : VI. P. 21. L. lat. 64. L. tr. 27.

Scomber Australasicus, *Cuv.* and *Val.* Australian Mackerel. D. 10 : 1·11 : V. A. 1 : 1·11 : V. L. lat. 160.

Thynnus thynnus, *L.* The Tunny. D. 14 : 1·13 : IX. A. 2·12 : VIII.

Auxis Rochei, *Risso.* A. D. 10-11 : 12. VIII : A. 12-14. VII.

Naucrates ductor, *L.* Pilot Fish. D. 3-6 : 1·26-28. A. 2·16-17.

Echeneis remora, *L.* Sucking Fish. D. 16-18 : 22-24. A. 25.

Fam. TRACHINIDÆ. (6.)

Kathetostoma læve, *Bl.* (A.Z.) Cat Fish. D. 17. A. 17. V. 1-5.

Percis Allporti, *Gunth.* (T.) D. 5 : 21. A. 16. L. lat. 62. L. tr. 3½ : 15.

Uphritis Urvillii, *Cuv* and *Val.* (T.) Sandy. D. 6 : 19. A. 25. L. lat. 65.

Sillago ciliata, *Cuv.* and *Val.* (A.) Whiting. D. 11 : 1·17-18. A. 2·18-19. P. 14-15. L. lat. 70. L. tr. 4-5 : 11-12.

Sillago maculata? *Quoy* and *Gaim.* (A.) Spotted Whiting. D. 11 : 1·20. A. 1·21. L. lat. 70. L. tr. 5-6 : 7.

Bovichthy's variegatus, *Rich.* D. 8 : 18. A. 13.

Fam. PEDICULATI. (2.)

Brachionichthys hirsutus, *Lacep.* (A.) Handfish. D. 1 : 2 : 16-19. A. 9. P. 7. V. 1·4.

Brachionichthys politus, *Rich.* (A.) Red Handfish. D. 1 : 2 : 17. A. 9. V. 1·4.

Fam. COTTIDÆ. (5.)

Platycephalus Bassensis, *Cuv.* and *Val.* (A.) Common Flathead. D. 1 : 7 : 14. A. 14. L. lat. 115.

Platycephalus cinereus, *Gunth.* (A.) Black Flathead. D. 1 : 7 : 12. A. 17. L. lat. 70.

Lepidotrigla vanessa, *Rich.* (A.) Butterfly Gurnard. D. 11 : 17. A. 17. L. lat. 70.

Trigla polyommata, *Rich.* (A.) Flying Gurnard. D. 7-9 : 12-13. A. 12.

Trigla kumu, *Less.* and *Gaim.* (A.Z.) Kumu Gurnard. D. 9-10 : 16-17. A. 15.

Fam. GOBIIDÆ. (2.)

Gobius Tamarensis, *Johnston.* (T.) Goby. B. 4. D. 6 : 1-8. A. 1·8. L. lat. 32. P. 16-18. C. 18-19.

Callionymus lateralis. *Macleay.* (A.) D. 4 : 8. A. 8.

Fam. BLENNIIDÆ. (8.)

Blennius Tasmanianus, *Rich.* (T.) Blenny or Bully. B. 6. D. 12 : 17-18. A. 2·19. P. 14.

Salarias meleagris, *Cuv.* and *Val.* (A.) Blenny. D. 12 : 20. A. 22.

Clinus despicillatus, *Rich.* (A.) Blenny. D. 3·35·4. A. 2·25. V. 1·3.

Clinus Johnstoni, *S. Kent.* (T.) Johnston's Blenny. D. 2-3 : 32-33 : 5. A. 2·25-26. V. 1·3.

Cristiceps Australis, *Cuv.* and *Val.* (A.) Blenny. D. 3·27-29·5-8. A. 2·23-25. V. 1·3.

Cristiceps Forsteri, *Cast.* (A.) Blenny. D. 3·29·4. A. 26. V. 1·3.

Tripterygium Clarkei. *Morton.* T. Blenny.

Patæcus armatus, *Gunth.* (A.) Patæcus. D. 32. A. 11. P. 8.

Fam. Sphyrænidæ. (2.)

Sphyræna Nova-Hollandiæ, *Gunth.* (A.) D. 5 : 1·9. A. 1·10. L. lat. 135.

Lanioperca mordax, *Gunth.* (A.) Tasmanian Jack. D. 5 : 1·19. A. 2·25-29. P. 16. L. lat. 61.

Fam. Atherinidæ. (6.)

Athernia presbyteroides, *Rich.* Silver Belly, Sand-smelt. D. 9 : 10-11. A. 1·12. P. 11.

Atherina hepsetoides, *Rich.* Silver Belly. D. 9 : 1·11. A. 1·14. P. 15.

Atherina hepsetus, *L.* Silver Belly.

Atherina microstoma, *Gunth.* Silver Belly. D. 6 : 1·10. A. 1·12. P. 12. L. lat. 40. L. tr. 8.

Atherina Tamarensis, *Johnston.* (T.) Silver Belly. 8 : 1 : 11. A. 1·10-11. P. 13. L. lat. 42. L. tr. 9.

Atherenichthys Jacksoniana, *Quoy* and *Gaim.* D. 8 : 1·11. A. 1·18.

Fam. Mugilidæ. (2.)

Mugil cephalotus, *Cuv.* and *Val.* (A.) Sand Mullet. D. 4 : 1·8. A. 3·7-8. L. lat. 38-40. L. tr. 14-15.

Agonostoma Forsteri, *Bl.* Sea Mullet, Estuary Mullet. D. 4 : 1·10. A. 3·12. L. lat. 55.

Fam. Centriscidæ. (1.)

Centriscus scolopax, *L.* (A.) Snipe, Bugler, or Trumpet Fish. B. 4. D. 5 : 12. A. 20. P. 16.

Fam. Gobiesocidæ. (2.)

Crepidogaster Tasmaniensis, *Gunth.* (A.) B. 5. D. 10. A. 9.

Gobiesox cardinalis, *Ramsay.* (T.)

Fam. Lophotidæ. (1.)

Lophotes Guntheri, *Johnston.* (T.) Lophotes.

Fam. Trachypteridæ. (2.)

Regalecus gladius. *Cuv.* and *Val.* Ribbon Fish. B. 6. D. 342. A. 0. C. 0. P. 14. V. 1.

Trachypterus altivelis, *Kner.* Paper Fish. B. 6. D. 7 : 190. A. 0. C. 6 : 4-6. P. 11. V. 7.

Fam. Pomacentridæ. (1.)

Glyphidodon Victoriæ. Rock Perch. D. 13 : 17. A, 2 : 15. L. lat. 30. L. tr. 4 : 10.

Fam. LABRIDÆ. (13.)

Cossyphus cerulæus, *Ogilby*. (A.) Blue Head.

Cossyphus unimaculatus, *Gunth.* (A.) D. 12 : 11. A. 3·12. L. lat. 36. L. tr. 6·12.

Labrichthys bothryocosmus, *Rich.* (A.) Parrot Fish. D. 9 : 11 : A. 3·10. L. lat. 27. L. tr. 3 : 9.

Labrichthys Mortoni, *Johnston*. Golden Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 23.

Labrichthys fucicola, *Rich.* Purple Parrot Fish. B. 6. D. 9 : 11. A. 3·10. L. lat. 27. P. 13.

Labrichthys psittacula, *Rich.* Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 27. L. tr. 3·9.

Labrichthys laticlavius, *Rich.* Blue-streak Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 26. L. tr. 3·9.

Labrichthys tetrica, *Rich.* Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 27. L. tr. 3·9

Labrichthys Cuvieri, *Cast.* Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 27.

Odax balteatus, *Cuv.* and *Val.* Ground Mullet. D. 15-17 : 12-13. A. 3·12-13. L. lat. 39.

Odax Richardsoni, *Gunth.* Stranger. D. 17 : 13-14. A. 3·10-12. L. lat. 60. L. tr. 7 : 20.

Odax Beddomei, *Johnston*. Beddome's Odax. D. 20 : 12. A. 3·9. L. lat. 40. L. tr. 3·8-9.

Olistherops Brownii, *Johnston*. Brown's Olistherops. D. 10 : 18. A. 3·9. L. lat. 58-60. L. tr. 7·14.

Fam. GADOPSIDÆ. (1.)

Gadopsis marmoratus, *Rich.* Freshwater Blackfish. B. 6. D. 10-13 : 25-26. A. 3 : 18-19. V. 1.

Fam. GADIDÆ. (2.)

Lotella Swanii. *Johnston*. Kelp Cod. B. 7. D. 4 : 60. A. 55. V. 8. P. 22-23. L. lat. 200.

Pseudophycis barbatus, *Gunth.* Rock Cod. D. 9-11 : 48-57. A. 44-57. V. 5. L. lat. 100-140.

Fam. OPHIDIIDÆ. (2.)

Genypterus Australis, *Cast.* Ling. B. 7. D. 159. A. 123-126. P. 19. L. lat. 261-307.

Fierasfer Homei, *Rich.* Home's Ling. B. 7. Fins very low. Continuous.

Fam. MACRURIDÆ. (2.)

Macrurus Australis, *Rich.* (A.) D. 13·88. A. 87. V. 7. L. lat. 130. L. tr. 4 : 15.

Coryphænoides Tasmaniæ, *Johnston*. (T.) Tasmanian Whip-tail. B. 7. D. 15 : 103. A. 90. V. 8.

Fam. Pleuronectidæ. (4.)

Amnotretis rostratus, *Gunth.* (T.) Sole. B 7. D. 79-81. V.. dext. 6-7.; sin. 4. L. lat. 89-90.

Rhombsolea monopus, *Gunth.* (A.) Flounder. B. 5. D. 59-60. V. 6. A. 42-43.

Rhombsolea tapirina, *Gunth.* (A.) Flounder. B. 6-7. D. 64-66. A. 46-50.

Solea liturata ? *Rich.* (T.) Richardson's Sole.

Fam. Haplochitonidæ. (2.)

Prototroctes maræna, *Gunth.* (A.) Freshwater Herring or Cucumber Fish. B. 6. D. 10. A. 19. O. 13. L. lat. 78. L. tr. 19.

Haplochiton Sealii, *Johnston.* (A.) Derwent Smelt. B. 6. D. 8-9. A. 19-20. P. 9-12.

Fam. Scopelidæ. (1.)

Alepidosaurus ferox, *Lowe.* (T.) B. 6-7. D. 41-44. A. 14-17. P. 14-15. V. 9-10.

Fam. Salmonidæ. (5.)

Retropinna Richardsoni, *Gill.* (A.Z.) Whitebait. B. 6. D. 11-12 : A. 17-20. P. 11. V. 6. L. lat. 61.

Salmo salar, *L.* (I.) Salmon. B. 11-12. D. 14. A. 11. P. 14. V. 9. L. lat. 120. L. tr. 22-26 : 19-22.

Salmo trutta, *Flem.* (I.) Salmon Trout. B. 11. D. 13. A. 11. P. 15. V. 9. L. 6-120. L. tr. 24-26 : 36-34.

Salmo fontinalis, *Milch.* (I.) Golden Trout.

Salmo fario, *var. Ausonii.* (I.) Brown Trout. D. 13-14. A. 10-11. P. 13. V. 9. L. lat. 120. L. tr. 26-30 : L. tr. 26 : 30.

Fam. Galaxidæ. (5.)

Galaxias truttaceus, *Cuv.* and *Val.* (T.) Spotted Trout. B. 9. D. 11. A. 14-15. V. 7. P. 14.

Galaxias auratus, *Johnston.* (D.) Golden Lake Trout. B. 9 D. 11-12. A. 14. V. 1·7. P. 16.

Galaxias attenuatus, *Jenyns.* (A.Z.) Jolly Tail. D. 12. A. 16. V. 7.

Galaxias Weedoni, *Johnston.* (T.) Mersey Jolly Tail. D. 11. A. 14. P 15.

Galaxias Atkinsoni, *Johnston.* (T.) Pieman Jolly Tail. B. 9. D. 11. P. 13. A. 14. V. 8.

Fam. Scombresocidæ. (1.)

Hemirhamphus intermedius, *Cant.* (A.Z.) Gar Fish. D. 15-17. A. 18-20. P. 11.

Fam. Cyprinidæ. (3.)

Carassius vulgaris, *Nilsson.* (I.) European Carp.

Carrassius auratus, *L.* (I.) Gold Fish.

Tinca vulgaris, *Cuv.* (I.) English Tench.

Fam. GONORHYNCHIDÆ. (1.)

Gonorhynchus Greyi, *Rich.* (A.Z.) Sand Eel. B. 4. D. 11-12. A. 9. V. 9.

Fam. CLUPEIDÆ. (3.)

Engraulis enchrasicholus *(var. antipodum)*, *L.* The Anchovy. B. 12-13. D. 16-17. A. 18-20. L. lat. 48-50.

Clupea sprattus, *L.* The Sprat. B. 6-7. D. 15-18. A. 17-20. V. 7. L. lat. 47-48.

Clupea sagax, *Jenyns.* Pilchard. B. 7. D. 18. A. 18-19. L. lat. 50-54.

Fam. SYMBRANCHIDÆ. (2.)

Chilobranchus dorsalis, *Rich.* (A.) Small Shore Eel.

Chilobranchus rufus, *Macleay.* (A.) Red-banded Shore Eel.

Fam. MURÆNIDÆ. (5.)

Anguilla Australis, *Rich.* (A.) Common Eel.

Conger vulgaris, *Cuv.* (A.) Conger Eel.

Conger Wilsoni, *Cast.* (A.Z.) Conger Eel.

Muræenichthys breviceps, *Gunth.* (A.)

Congromuræna habenata, *Rich.* (A.Z.) Silver Eel.

Fam. PEGASIDÆ. (1.)

Pegasus lancifer, *Kaup.* (A.) Pegasus. D. 5. A. 5. P. 15. V. 2.

Fam. SYNGNATHIDÆ. (9.)

Syngnathus, semifasciatus, *Gunth.* (A.) Pipe Fish. D. 38. O. R. 21+49.

Syngnathus curtirostris, *Cast.* (A.) Pipe Fish. D. 20-22. O. R. 18+42.

Stigmatophora argus, *Rich.* (A.) Pipe Fish. D. 49-52. O. R. 20+75.

Stigmatophora nigra, *Kaup.* (A.) Pipe Fish. D. 39-40. O. R. 17+42.

Stigmatophora gracilis, *Macleay.* (T.) Pipe Fish. D. 58. O. R. 30+56.

Solenognathus spinosissimus, *Gunth.* (A.) Pipe Fish. D. 35. O. R. 27+56.

Phyllopteryx foliatus, *Shaw.* (A.) Leaf-winged Sea Horse. D. 30. O. R. 18+35.

Hippocampus abdominalis, *Kaup.* (T.) Sea Horse. D. 28-31.

Hippocampus breviceps, *Peters.* (A.) Yellow-ringed Sea Horse. D. 19-21.

Fam. Sclerodermi. (12.)

Monocanthus Gunnii, *Gunth.* Dark Brown Leather Jacket D. 34. A. 33.

Monocanthus convexirostris, *Gunth.* Grey Leather Jacket. D. 34-37. A. 32-35.

Monocanthus Peronii, *Holland.* Pale Brown Leather Jacket. D. 33-35. A. 33.

Monocanthus Guntheri, *Macleay.* Tooth-brush Leather Jacket.

Monocanthus spilomelanurus, *Quoy* and *Gaim.* Golden Streak-eyed Leather Jacket. D. 30-32. A. 28-32.

Monocanthus maculosus. *Rich.* Small Brown Leather Jacket. D. 29-33. A. 29-30. P. 12.

Monocanthus Baudini, *Cast.* Lozenge-scaled Leather Jacket. D. 35. A. 31. P. 13.

Monocanthus melas, *Gunth.* Black Leather Jacket. D. 34. A. 34.

Monocanthus rudis, *Rich.* White-banded Leather Jacket. D. 34-35. A. A. 34.

Monocanthus hippocrepis, *Quoy* and *Gaim.* Blue-banded Leather Jacket. D. 35-37. A. 33-36.

Ostracion auritus, *Shaw.* Trunk Fish. Head spine deflected.

Ostracion ornatus, *Gray.* Trunk Fish. Head spine erect, pointing out.

Fam. Gymnodontes. (5.)

Tetrodon Hamiltoni. *Rich.* Toad Fish.

Tetrodon Richei, *Frem.* Globe Fish.

Chilomycterus jaculiferus, *Cuv.* A. Porcupine Fish.

Atopomycterus nychthemerus, *Cuv.* Slender spined Porcupine Fish.

Orthagoriscus mola. *L.* Sun Fish. D. 17-18. A. 14-17. C. 12-16. P. 12-13.

Sub-Class. CHONDROPTERYGII.

Fam. Chimæridæ. (1.)

Callorhynchus antarcticus, *Lacep.* Elephant Fish.

Fam. Carcharidæ. (4.)

(Eye with a nictitating membrane. 1 anal and 2 dorsal fins.)

Carcharius glaucus, *L.* (E.) Blue shark.

Galeus canis, *Rondel.* (E.) The Tope. School Shark.

Zygæna malleus, *Shaw.* Hammer-head.

Mustelus antarcticus, *Gunth.* Smooth Hound. Gummy.

Fam. Lamnidæ. (3.)

(No nictitating membrane. 1 anal and 2 dorsal fins.)

Lamna cornubica, *Flem.* Porbeagle.

Odontaspis Americanus, *Mitch.* Grey Nurse.

Alopecias vulpes, *L.* Thrasher.

Fam. Notidanidæ. (1.)

(1 dorsal only. 1 anal.)

Notidanus indicus, *Cuv.* Tasmanian Blue Shark

Fam. SCYLLIDÆ. (4.)

(No nictitating membrane. 2 dorsal and 1 anal fin).

Scyllium maculatum. *Bl.*
Scyllium laticeps, *Dum.*
Parascyllium variolatum, *Dum.*
Crossorhinus barbatus, *L.* Wobbigong.

Fam. CESTRACIONIDÆ. (1.)

(No nictitating membrane. 2 dorsal and 1 anal fin.)

Heterodontus Phillipii, *Lacep.* Port Jackson, or Bull-head Shark.

Fam. SPINACIDÆ. (2.)

(No nictitating membrane. No anal fin.)

Acanthias vulgaris, *Risso.* A. Spotted Spiny Dog.
Acanthias Blainvillii, *Risso.* A. Spiny Dog.

Fam. RHINIDÆ. (1.)

(No anal fin. Pectoral fins large.)

Rhina squatina, *L.* Angel Shark.

Fam. PRISTIOPHORIDÆ. (2.)

(Snout much produced, saw-like.)

Pristiophorus cirratus, *Latham.* (A.) Sawfish. Sets teeth upper jaw, 42.
Pristiophorus nudipinnis, *Gunth.* (A.) Sawfish. Sets teeth upper jaw, 35-39.

RAYS.

Fam. RHINOBATIDÆ. (1.)

Trygonorhina fasciata, *Mull and Henle.* The Fiddler.

Fam. TORPEDINIDÆ. (1.)

Narcine Tasmaniensis, *Rich.* Electric Torpedo. Disc elliptical.

Fam. RAJIDÆ. (1.)

Raja Lemprieri, *Rich.* Thorn-back Skate.

Fam. TRYGONIDÆ. (1.)

Urolophus cruciatus, *Lacep.* Stingaree.

Fam. MYLIOBATIDÆ. (1.)

Myliobatis aquila. *L.* Eagle or Whip-tail Ray.

SUB-CLASS. CYCLOSTOMATA.

Fam. PETROMYZONTIDÆ. (2.)

Mordacia mordax, *Rich.* (A.) Common Lamprey.
Geotria Allporti, *Gunth.* (T.) Pouched Lamprey.

SUB-CLASS LEPTOCARDII.

Fam. CIRROSTOMI. (1.)

Branchiostoma lanceolatum, *Pall.* The Lancelet.

FISHING INDUSTRY.

With a scattered and insulated population of about 150,000 inhabitants, it cannot be expected that the fishing industry of Tasmania can be extensive. Nevertheless it is estimated that there are about 86 boats and 175 men engaged therein. The individuals employed hawking the fish within the two chief towns may be estimated at about 80 in number. Altogether it is estimated that, exclusive of the whaling trade, there are 1,050 persons directly depending upon the local fisheries. Hobart, the capital city, is the chief centre of the industry, its position being favourable in this respect from its proximity to the principal fishing-grounds, and its splendid harbour being accessible in all kinds of weather.

Fully 63 per cent. of the men and boats belong to Hobart, and the men carry on their vocation either in the numerous sheltered indentations or bays in the upper or lower waters of the estuary of the Derwent, or in the exposed open sea between Seymour on the north-east and Port Davey on the south-west. The fishing carried on elsewhere, with the exception of the purely river fishing of the Tamar, is very limited, generally engaged in at odd times by persons who do not devote themselves exclusively to the fishing industry. The Tamar boats are not suited for fishing in the open sea of Bass Straits.

With the exception of three or four decked smacks, the most of the boats employed in the waters of the Derwent, or in the open sea Trumpeter and Barracouta fishing-grounds, are mere open centre-board whaleboats, fitted with fish-wells perforated in direct communication with the sea, and designed to keep the fish alive until sold in the open market in the Fisherman's Dock, Hobart.* The Trumpeter and other fish will feed in such confinement, and the former has been known to live healthily in this way for a period of three months.

The average value of one of these excellent sea-boats† is about £100, and the equipment, in the shape of nets and deep sea lines, say £20; in all, say £120 for each boat. There are usually two or three men to each boat. Even with a small crew of this kind, as much as 40 dozen Kingfish, weighing 12 to 14lbs. each, have been caught in a single night when the fish have been plentiful. Barracouta can be captured in large quantities during the season—January to June. About 24 dozen Barracouta weigh a ton. The fishermen state that, could they be assured of a market, 3s. a dozen for Barracouta or Kingfish would amply repay them,—*i.e.*, about ¼d. a pound.

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* Salt water.

† Generally about 37 feet 6 inches long; beam, 7 feet 8 inches; depth, about 3 feet.

The following are additional particulars regarding the average quantity of fish exported each year, which hitherto have been despatched almost wholly to Victoria:—

	Doz.	Weight.	Average Price.
		lbs.	
Trumpeter (*Latris hecateia*)...	66	3 to 60	1s. per lb.
Perch (*Chilodactylus macropterus*)...........................	123	2 to 7	6s. to 7s. per doz.
Trevally (*Neptonemus brama*)...	52	1 to 14	8s. to 12s. per doz.
Barracouta (*Thyrsites atun*).....	1132	9 to 10	3s. per doz.
Kingfish (*Thrysites Solandri*)...	1056	12 to 14	3s. per doz.
Conger Eel (*Conger vulgaris*)...	44	7 to 50	½d. per lb.
Crayfish (*Palinurus Edwardsii*)	923	avg. 4	5s. per score.
Total per year...............	3396		

It is very difficult to estimate the value of fish sales, as no systematic register has been kept for the whole colony. It is probable, since the decline of the Oyster fishery, that the yearly sales do not exceed £10,000 per annum.

The value of boats and equipment at present engaged in the fishing industry of Tasmania may be roughly estimated at about £7,700. This does not embrace the ships employed in the Whale fisheries. The latter industry has declined considerably during the last decade, as shown by the following summary:—

	Average per year, First Quinquennium.	Average per year, Second Quinquennium.
Ships	16	11
Tonnage	4,164	3,055
Men	390	312
Value of Oil......	£31,281	£19,223

The reason of this falling off is stated to be chiefly owing to the decline in price arising from the introduction of minerals oils. Excessive fishing and consequent scarcity of oil is also referred to as a cause of decline.

FISHING GROUNDS.

Generally, the Fishing Grounds may be divided into three classes:—1. The Home Grounds 2. The Middle Grounds. 3. The Outer, or Open-sea Grounds.

1. *The Home Grounds*, near shore, or in the upper shallows of the estuaries of the Derwent and Tamar.—The fishing grounds at Port Sorell, Bridport, and George's Bay may be included with this division. The fish captured in these situations consist chiefly of Flounders, Mullet, Garfish, Flathead. Crayfish, Prawns, and Oysters are also taken in the Home Grounds.

2. *The Middle Grounds.*—Within this division may be included those fishing reefs and banks lying in the more exposed situations of estuaries—such as Wedge Bay and Adventure Bay, in the Derwent—in depth of water from five to six fathoms. In such localities the grab-all net and ordinary hand-lines are used in the capture of Native Salmon, Silver Bastard, Black and Silver Perch, Carp, Rock Cod, Ling, Conger Eel, etc. The indentations around the Eastern and Western Coasts afford ample scope for following out the industry within the limits of this division, especially so in the many sheltered bays in the neighbourhood of Port Davey and Macquarie Harbour.

3. *The Outer, or Open-sea Grounds.*—These principally are situate in the southern and eastern waters of Tasmania, and generally from 1 to 16 miles off the coast, upon coral banks or reefs 10 to 80 fathoms deep. The latter depth is the limit at which Tasmanian fishermen have been successful with deep sea-lines on the Trumpeter banks. Towards the surface of these open waters the Maori jig is principally used in the capture of the Barracouta, and in the season the line, armed with swivelled chain and stout barbless hook, is employed in the capture of the rapacious but valuable Kingfish.

The fishermen, as a class, are as a rule steady and industrious, and although they do not seem to have any special provision in the shape of Friendly Societies or other providential aids, distress is rare and poverty unheard of. Beyond the provisions for acclimatisation and protection of the European Salmonidæ, the establishment of Oyster beds for breeding purposes, and certain reserves for the protection of natural beds, the Government have also found it necessary to provide measures for the limitation of the sale of unwholesome or undersized fish, and for prescribing the size of mesh for *graball* and *seine nets.* No graball can be used in Tasmanian waters whose mesh is of any size, measured diagonally, between 2½ inches and 4 inches.

The prescribed limits of undersized fish that may be taken or sold are:—

Bastard	12 inches and over
Real Trumpeter	13 " " "
Garfish	8 " " "
Bream	10 " " "
Flounders...	9 " " "
Crayfish	10 " " "

In the case of the introduced Salmonoids, and as regards the Oyster and Flounder, special provisions have been made for their preservation and development in respect of close seasons, modes of capture, and the absolute or partial closing of particular areas as nursery grounds as a means of protection. This was absolutely necessary to ensure the successful acclimatisation of the Salmonidæ first introduced from Europe in the year 1864.

The fishes successfully introduced are *Salmo salar, Salmo trutta, Salmo fario* var. *Ausonii, Salmo fontinalis, Tinca vulgaris, Cyprinus auratus, Cyprinus carassius, Perca fluviatilis.*

FISH SOLD IN HOBART FISH MARKET DURING THE YEAR 1888.

	Quantity	Price.			Value.		
Fish.		Max.	Min.	Average	£	s.	d.
Barracouta ....doz.	2,410	10s.	7s.6d.	8s.	964	0	0
Bream .... "	9	14s.	8s.	10s.	4	10	0
Carp .... "	103	5s.	3s.	4s.	20	12	0
Eels (Conger)............ "	70	12s.	10s.	11s.	38	10	0
Flathead .... "	2,241	1s.	1s.	1s.	112	1	0
Flounders .... "	1,126	6s.6d.	4s.	5s.	281	8	0
Garfish .... "	10,229	1s.	5d.	6d.	255	14	6
Gurnet (Rock).......... "	111	4s.	2s.9d.	3s.	16	13	0
Kingfish .... "	¾	60s.	60s.	60s.	2	5	0
Ling .... "	21	24s.	3s.	7s.	7	7	0
Mullet .... "	3,202	1s.9d.	4d.	1s.	160	0	0
Mackerel (Horse)...... "	68	2s.	4d.	1s.	3	8	0
Perch .... "	3,629	5s.	3s.6d.	4s.	735	16	0
Ditto (Red)........... "	3	4s.	4s.	4s.	0	12	0
Rock Cod................ "	2,158	2s.	1s.	2s.	215	16	0
Salmon (Native)....... "	2,358	1s.	4d.	8d.	78	12	0
Trumpeter (Real)....... "	447	100s.	20s.	31s.7d.	737	10	0
Ditto (Red Bastard) "	3,431	5s.6d.	4s.	5s.	857	15	0
Ditto (Silver ditto).. "	46	48s.	12s.	17s.6d.	30	12	6
Trevally .... "	75	6s.	2s.	4s.	15	0	0
Whiting.................... "	16	3s.	1s.	1s.6d.	1	4	0
Crustaceans.	31,753				4,539	6	0
Crayfish .... score	3,434	5s.	4s.	5s.	858	10	0
Molluscs.							
Cockles .... bushels	8	5s.	5s.	5s.	2	0	0
					£5,399	16	0

SALMON AND TROUT BREEDING ESTABLISHMENT.

	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Ova introduced from Europe ...	...	...	80,000*	160,000*	...	...	400,000*
Ova exported to other Colonies..	24,000	17,000	2,000	7,500	13,000	12,000	6,000
Salmon Fry liberated in various Rivers, etc.......	3,950	6,600	8,650	31,229[d]	116,200	33,880	9,000
Licences issued—Receipts from Sales of Ova and Licenses...	297	266	216	253	263	269	258
Working Expenses	277[a]	319	355[b]	465[c]	341	296	437

* *Salmo salar.*

[a] Exclusive of £100 for importation of ova.

[b] Exclusive of £460 for importation of Ova from England.

[c] Includes £170, special repairs to troughing.

[d] Includes 28,128 fry of *S. salar*, *ex* ova per *Yeoman*, from Ireland, hatched at the Plenty.

GENERAL FISHERIES DEPARTMENT.

	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Receipts................	...	...	...	...	...	...	...
Working Expenses..	...	...	...	935	...	1,369	677

Whale Fisheries.

Year.	Vessels employed.		Tonnage.	Value of Fisheries.	Remarks.	Foreign.	
	Ships.	Boats.		£		Ships.	Tonnage.
1828	3	23	...	11,268	In 1822, 724 tuns oil and 3 tons whale fins were exported. In 1823 226 casks of oil and 52 pkgs. whalebone were exported.		
1829	7	26	...	12,313			
1830	10	42	...	22,065			
1831	9	55	...	33,549			
1832	12	75	...	37,176			
1833	15	105	...	30,620			
1834	23	84	...	56,450			
1835	35	155	...	64,858			
1836	14	48	1,187	57,660			
1837	18	75	2,739	135,210			
1838	19	79	1,999	98,660			
1839	26	...	3,146	65,600			
1840	27	...	3,224	66,850			
1841	22	...	3,170	71,600			
1842	18	...	2,842	87,400			
1843	21	...	3,307	74,100			
1844	24	...	4,264	49,840		12	3,838
1845	28	...	4,460	73,300		16	5,518
1846	28	...	4,057	65,150		13	4,825
1847	27	...	4,729	70,000		21	6,890
1848	29	...	6,081	104,000		26	8,497
1849	34	...	7,791	46,117		11	3,803
				Oil exported.			
1850	40	...	9,724	49,547		9	2,779
1851	26	...	6,538	49,022		14	4,687
1852	18	...	3,999	36,776		18	6,300
1853	7	...	1,903	30,106		2	704
1854	6	...	1,622	27,863		2	737
1855	17	...	3,566	44,110			
1856	33	...	6,975	53,670			
1857	...	...	...	46,211			
1858	...	...	...	49,878			

Year.	Vessels.	Tonnage.	Value of Oil Exported.	No. of Men.
			£	
1859	...	...	63,500	...
1860	...	...	57,350	...
1861	...	...	60,230	...
1862	...	...	60,730	...
1863	...	...	30,175	...
1864	...	...	19,925	...
			Produce brought into Port.	
1866	9	2,257	38,000	229
1867	10	2,428	22,800	245
1868	16	3,996	52,546	395
1869	17	4,364	48,910	415
1870	15	3,446	35,880	376
1871	19	4,917	46,350	470
1872	19	4,917	27,420	488
1873	18	4,765	44,000	444
1874	16	4,088	30,780	389
1875	13	3,525	12,465	315
1876	13	3,525	41,740	315
1877	12	3,295	31,605	324
1878	11	3,156	16,920	321
1879	11	3,156	13,425	326
1880	10	2,780	12,045	296
1881	10	2,780	22,120	296
1882	8	2,357	19,096	196
1883	7	2,014	14,685	168
1884	6	1,745	11,715	151
1885	7	2,014	12,600	167
1886	5	1,480	6,150	124
1887	4	1,151	10,450	99
1888	3	783	6,165	70

DO THE CHANGES OF THE MOON AFFECT THE RAINFALL?

BY E. C. NOWELL, HON. MEMBER ROYAL STATISTICAL SOCIETY.

The idea that the changes of the moon do affect the rainfall has widely prevailed from the earliest ages. Thus the Roman poet Virgil :—

> " And that by sure prognostics we may know
> Both heat and rain and cold-compelling winds,
> The Sire himself has fixed the monthly course
> Of lunar indications; by what sign
> To read the sinking south ; what, oft observed,
> Should teach the farmer to retain his herds
> Within the sheltered precincts of the stall."
>
> Georg. I., 351 seqq., Dear's trans.

> " Nor less are showerless suns and open sky
> Serene by certain signs fore-known ; for then
> Nor dimly seem the blunted stars to shine,
> Nor rises Luna to her brother's beams
> Indebted : then nor through the vault of heaven
> Sail fleecy clouds ; nor to the genial beam
> Do Thetis' halcyons spread their azure wings.
>
> * * * *
>
> When the moon,
> Collecting first her renovated fires,
> A gloomy mist within her horns includes,—
> Then on the husbandman and on the deep
> Impends a heavy rain ; but, if she rise
> Her face suffused with virgin blushes, wind
> Awaits ; the wind on golden Phœbe's cheek
> Ever excites a blush ; but should she take
> At her fourth rising (mark the surest sign)
> Her course through heaven's ætherial way with clear
> Unclouded aspect, nor with horns obtuse,
> Then that whole day and those from thence derived,
> E'en to the finished month, shall roll exempt
> From wind or rain; and, on the shore secure,
> The storm-scaped mariner shall pay his vows
> To Glaucus, Panope, and Ino's son."
>
> Ib., 393 seqq.

Ages before, the Babylonian Government astronomers in their reports, which they furnished daily, have such entries as these respecting the supposed influence of the heavenly bodies on the weather :—

"The star of the upper sphere aforesaid causes fog and rain."

"The star Lulu portends extended mists."

"The star of the Wolf portends tempest."

"The stars at sunrise are for windy rain and flood."

Sailors especially are great believers in the influence of the moon on the weather.

I believe it will be found that, where ideas have become deeply rooted and widely spread, it is very seldom, if ever, that they have not some foundation in fact, though the fact may have been distorted, and the truth more or less obscured.

We have been assured, however, by some whose names carry great weight, and whose statements on such matters we should not venture to question, except on the clearest evidence, that the popular notion is a mere delusion, and that the moon's changes have no influence on the weather.

Dr. R. J. Mann, vice-president of the Meteorological Society, in an article on "High Clouds and Moonshine," in "Science for All," part 52, says:—"Amongst the long prevalent notions that have been held concerning the changes of the weather, there are, perhaps, none that have been more generally entertained and cherished than those which connect them with what are termed the changes, or, in other words, recurring phases of illumination of the moon. These notions, in all probability, were in the first instance derived from the accidental coincidence of certain marked conditions of weather with particular aspects of the moon, and from the natural tendency which exists in the minds of superficially instructed people to ascribe to the heavenly bodies a power over human events. A very few words of comment will, nevertheless, suffice to expose the fallacy of this illusion. The proposition, however, to which these remarks are addressed is, it must be remarked, not simply and in a general sense that the moon affects the weather experienced upon the earth, but that the mere aspects of the moon's varying illumination exert an especial influence upon the weather of each particular locality and spot.

"The utter irrationality and absurdity of this idea becomes apparent at a glance the instant it is connected with the obvious fact that the earth is a rotating and not a fixed globe. Assuming, for the mere purpose of illustration, that it were true the new moon, the half moon, and the full moon produced some especial state, whether of storm or of calm, whether of rain or of dryness upon some given spot on the earth, as this passes round in front of the sun-illumined orb, it is manifest the same influence must continue to be exerted entirely round the earth during the subsequent twenty-five hours in which the terrestrial sphere whirls completely round before the moon;" and so on. Further on, he says:—"If the phases of the moon affected the weather, it is obvious that the same weather would prevail wherever analogous relations to the moon obtained.

"The moon, as a matter of fact, does produce a physical influence upon the earth, but it is an influence of an altogether different kind to the one which is implied by this popular piece of weather delusion; it is the influence which is so grandly expressed in the diurnal roll of the tides of the sea, and which is due to the inter-action of the lunar and terrestrial mass." In regard to the tides the same writer tells us: "It is the moon which is operative in bringing about the result, and not the 'phases' or appearance of the moon."

But, we may ask, is not the distinction here drawn between the moon herself and her "phases" rather one of words than of things? If the moon's changes of position, which we call her "phases," cause corresponding changes in the weather, there certainly would be good reason for associating such changes with the phases under which they occur, whether the popular mode of stating the fact were strictly correct or not.

Dr. Mann goes on to say: "Now, there can be no question that the moon does produce a somewhat similar effect upon the atmosphere to that which it exerts upon the sea. As it goes round the earth, and as the earth whirls upon its axis in front of the attendant orb, a tidal swell is called up in that part of the atmosphere which is most immediately opposite and nearest to the lunar mass;* and this tidal wave in the air undoubtedly is accompanied by some change of physical state which would involve alteration of pressure, and which would be to that extent indicated by the barometer, and would tend to produce movement in the air or wind, and such weather change as is attendant upon wind. But all this, it will be observed, has nothing whatever to do with the phases or changes of the moon. The effect, whatever it may be, is precisely the same whether the moon is new, or half illuminated, or full. It is determined and measured only by the revolution, distance, and mass of the moon, and by the dimensions and rotation of the earth." But the inference is drawn from certain observed facts "that the heat reflected from the full moon does exert a palpable effect upon the atmosphere, although it does not penetrate to the solid surface of the earth;" and Sir John Herschel is said to have noticed "how very commonly the nights of the full moon at the Cape of Good Hope were absolutely cloudless and clear;" and this observation, we are informed, is confirmed by the experience of nearly nine years of the author of the article from which I have quoted in the neighbourhood of Natal.

Dr. Lardner, in his "Weather Prognostics" (Museum of Science and Art, vol. I. p. 80), after reviewing the investigations of different persons on the subject of the moon's influence on the weather, observes: "Those who are impressed with the feeling that an opinion so universally entertained, even in countries remote from each other, as that which presumes an influence of the moon over the weather, must have some foundation, will do well to remember that against that opinion we have not here opposed mere theory. Nay, we have abandoned for the occasion the support that science might afford, and the light it might shed on the negative of this question, and have dealt with it as a mere question of fact. It matters little, so far as this question is concerned, in what manner the moon and sun may produce an effect on the weather, nor even whether they be active causes in producing such effects at all. The point, and the only point of importance is, whether regarded as a mere *matter of fact*, any such correspondence between the changes of the moon and those of the weather exist, as is popularly supposed? And a short examination of the recorded facts proves that IT DOES NOT." And Dr. Ball, Royal Astronomer of Ireland, in his "Story of the Heavens," published in 1886, p. 59, says: "There is one widely credited myth about the moon which must be regarded as devoid of real foundation. The idea that the moon and the weather are connected has no doubt been entertained by high authority, but careful comparison has shown that there is no definite connection between the two." I venture to think that the results which I shall bring before the members of this Society will show that these opinions are premature, and will have to be modified, and that, after all, the popular persuasion is not without some foundation in fact.

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* One cannot help noticing the remarkable coincidence between the words of the ancient poet already quoted, *fratris radiis obnoxia Luna*, and those of the exponent of modern science.

Seeing that the statements of scientific men and the popular notions on the subject of the moon's influence on the weather seemed to be at variance, I resolved to investigate the matter for myself; and accordingly in 1880 I began to keep a meteorological journal in a rough way, and have continued it up to the present time. There is only one hiatus of about a fortnight, caused by my absence from home. Having now ten years' observations to work upon, I thought I might safely proceed to ascertain what conclusions might be drawn from them, and with that view prepared table B appended to this paper.

It should be mentioned that every fall of rain, however slight, unless unintentionally omitted, is recorded; and that rain is noticed in the tables only on the first day on which it occurs in connection with any particular change. When, therefore two or more rain-days come together, only the first is tabulated, the others being omitted: but when a break of a whole day occurs, any subsequent fall of rain is treated as distinct, and tabulated accordingly.

I have thought it better not to go beyond the seventh day, since it is only occasionally that the interval between one change of the moon and another extends beyond that day.

By way of testing the accuracy of my own observations, I constructed another table (A) on the same principles, from the data furnished by the late Mr. F. Abbott, and published in the papers of this Society, taking in the previous ten years, from 1870 to 1879 inclusively. If the two tables be thrown into one, they will embrace a period of twenty years, from 1870 to 1889. In Mr. Abbott's tables, as printed, I found two gaps, one of a month, and another of a fortnight, but was fortunately able to supply the omissions from the meteorological journal kept by Mr. W. E. Shoobridge, which he was kind enough to leave in my hands.

My observations, as thus tabulated, give the following results for the ten years from 1880 to 1889.

Taking first the totals opposite to each day, without reference to the nature of the moon's changes, we find that the number of times on which rain commenced in the decennium as a whole was as follows :—

On the day of the change	114
„ second day „	103
„ third „ „	98
„ fourth „ „	92
„ fifth „ „	88
„ sixth „ „	73
„ seventh „ „	82

It will be seen that the number on the day of change is considerably in excess of the number on any of the other days, being at the rate of 18 per cent. nearly of the whole number (650) on the seven days, while the next highest is only about 16 per cent.

The corresponding numbers for the period 1870-79 were :—

On the day of the change	135
„ second day „	80
„ third „ „	97
„ fourth „ „	81
„ fifth „ „	93
„ sixth „ „	83
„ seventh „ „	84

Here again we find the largest number on the day of the change. But in regard to the other days, the two periods vary. In the first decennium (1870-79) the next largest was on the third day; in the second decennium (1880-89), on the second.

The proportion which the numbers on the day of change bore to the total (653) on all the seven days in the first period was nearly 21 per cent.

In the second decennium (1880-89) it was found that the next largest figure was that opposite to the second day; while, in the first decennium, the next largest was in connection with the third day. Taking the two periods together the relative frequency of rain in the twenty years would be as follows:—

First day of change	249	
Second day "	183	
Third " "	195	
	—	627
Fourth " "	173	
Fifth " "	181	
Sixth " "	156	
Seventh " "	166	
	—	676
		1,303

Thus, it appears that 48 per cent. of the rainfalls, as here noted, occurred on the first three days of the moon's changes, being only 2 per cent. less than in the remaining four days. It will be observed that the numbers are appreciably smaller on the sixth and seventh days.

Taking now the totals under each of the moon's quarters, in the two periods, we get the following results:—

1880-89.

Total number of initial rainfalls in the whole period in	Last quarter,	159
	New moon,	165
	First quarter,	167
	Full moon,	162

1870-79.

Total number of initial rainfalls in the whole period in	Last Quarter,	177
	New Moon,	146
	First Quarter,	177
	Full Moon,	150

So far as these periods, taken separately, go, we cannot discover any law of relation between the changes, or quarters, of the moon, and the rain-fall; but when we combine the totals of the two tables and take the whole period of twenty years, the result is similar to that which we get from the latter of the two decennial periods (1870-79), the numbers for the twenty years being:

Last Quarter ...	336
New Moon ...	311
First Quarter ...	344
Full Moon ...	312

The difference between the two pairs, the first and last quarters on the one hand, and the new and full moon on the other, are so marked, as at once to suggest the idea that it is not altogether due to chance. If this be so, then there is a greater probability of rain occurring at the first and last quarters than at the new and full moon.

In my enquiries I have not given any attention to the question how far, if at all, the rain-fall is affected by the moon's apogee or perigee. But it is only reasonable to suppose that, if the greater or less proximity of the moon to the earth affects the tides, it must also cause some corresponding modification in those conditions of the atmosphere which regulate the suspension and condensation of moisture in the upper regions.

Lardner, in the work above cited, tells us that Toaldo, from a comparison of 45 years' observations at Padua, found that in every six passages of the moon through perigee there were five changes of weather, and in every five through apogee there were four changes of weather (p. 72); and that Professor Pilgrim, from a 25 years' series of observations at Vienna, arrived at the result that the influence of perigee is greater than that of any of the phases, while the influence of apogee is equal to that of the quarters and full moon, and greater than that of the new moon (p. 73). But Lardner considers that the mode in which these conclusions were reached was such as to throw some doubt upon the results. He seems to attach more weight to the investigations of M. Schübler, who, from observations taken at Munich, Stuttgard, and Augsburg, for 28 years, found that during the seven days nearest to perigee it rained 1,169 times, and during the seven days nearest to apogee, only 1,096 times. "Thus," remarks Lardner, *cæteris paribus*, the nearer is the moon to the earth the greater would be the chances for rain" (p. 75).

Further on he says: "From all that has been stated it can scarcely be denied that there exists some correspondence between the prevalence of rain and the phases of the moon. What that exact correspondence is, remains for more extended and accurate observations to inform us; but meanwhile it may be safely affirmed that it is not such as to constitute a prognostic in any sense approaching to that in which it has been popularly adopted." *(Ib.)*

With this I entirely agree; and, so far as the foregoing enquiries enable us to pronounce an opinion on the subject, the only thing which we can with any safety assert with regard to this subject, is, that there is a greater probability of having rain on the first than on any succeeding day of any of the moon's changes.

The enquiry, the results of which I have thus attempted to put before the members of this Society, will, I hope, be found to be of some value, however slight, as a contribution towards the investigation of an obscure but highly interesting subject.

Perhaps these remarks may induce others, more competent, to pursue the enquiry in a more scientific manner, and more exhaustively, than I have been able to do.

It will, of course, be understood that the inferences deduced from the appended tables are intended to apply only to the place where the observations were made, namely—Hobart and its vicinity. We may expect to get different results from similar observations at other places, and it remains to be seen whether the same laws hold good elsewhere under different conditions, or whether they are so far modified by local circumstances that each place, or group of places, has a law of its own.

In a work which I was reading a short time since, I came upon this passage:—"It is a scientific fact that virtue and vice are resultant upon the changes of weather. The police of Buenos Ayres find that quarrelling and bloodshed are more frequent when the wind blows from the north, that a sort of moral derangement prevails while it continues. The scientific explanation offered is, that this arises from some malaria engendered in the marshes over which the wind passes." (W. J. Acomb, Larger Hope Lectures, 156.)

This opens up a wide field of study which has not, as far as I know, been systematically cultivated. The present age stands out prominently as one of *disinterment*. Buried cities, such as Nineveh, Babylon, Herculaneum, Pompeii, Troy, have been unearthed; lost languages and literature have been restored. If the same method of enquiry be applied to immaterial things there can be no doubt that similar results will follow. If we closely examine many of the things which in past times were devoutly believed, but which most people in these days look upon as exploded errors, we shall find that, just as gold is embedded in quartz and has to be separated from it, in these old notions there are truths which only require to be set free from the misconceptions which were associated with them to be recognised as scientific facts. Take, for instance, lunacy. The idea was that the aberration of mind so-called, was occasioned by some malign influence of the moon. Increased knowledge has shown that the causes of insanity are very various, and that the moon has little, if anything, to do with them; but if I am not mistaken, many mad people *are* peculiarly affected at certain states of the moon, and the observation of this fact may have led to the assumption that the moon was the cause of the disease. We have seen that she does produce such an effect upon the atmosphere as to bring on rain under certain conditions. But as the organism of both men and animals is affected by changes of weather, and as such changes are, more or less, brought about by lunar action, it follows of necessity that the moon does exercise a certain amount of control over the bodies and minds of living things, though, doubtless, not in the way and to the extent formerly imagined. Many persons of sensitive temperament are powerfully affected by moonlight; and we can easily understand how much greater the impression must be when the mind is off its balance.

Take, again, astrology. Of course, none of us believes in astrology, as commonly understood—that is, we do not believe that men's future destinies can be read in the stars in the same way as the astrologers pretended; but I think there are grounds for admitting that the stars may, like the moon, only in a less degree, have an influence on human affairs. Some years ago (in 1876) it was predicted that a rare conjunction of the greater planets would cause unusual perturbations on our earth; and certainly in the last ten years there have been greater disturbances in the physical world than have ever occurred before in my time. And in the moral world there have been corresponding disorders. It is quite conceivable that these abnormal phenomena may have had their origin in some changes of the other planets in relation to the earth, altering the force of their attraction, and so, perhaps, the magnetic condition of our globe. Whatever affects our physical state produces a corresponding change in the mind and its affections, and thus many of the remarkable tendencies of our time may be the result of atmospheric or telluric influences due to some obscure changes occurring elsewhere in the universe of which we form a part. If it be true, as modern science teaches, that the whole of creation is so bound together, and so finely adjusted, that whatever takes place anywhere produces some effect on every other portion, we need not stumble at the thought that the vast masses of matter which whirl round the centre of our system may, by their changes of position, alter the condition of things on our planet, and so have an influence upon our physical, moral, social and spiritual life.

If this be so, then it will be within the province of science to extend its researches in this direction, in order to discover, if possible, what are the exact nature and limits of the influence exerted upon the earth and its inhabitants by the moon and the remoter planets—the lesser forces—as well as by the great central source of power—the sun itself.

TABLES.

Number of days on which rain began to fall in the two decennial periods, 1870-79 and 1880-89, in connection with the changes of the moon:—

A. 1870-79.

Days of and following the Moon's Changes.	Last Quarter.	New Moon.	First Quarter.	Full Moon.	Total.
1	37	37	35	26	135
2	20	19	21	20	80
3	22	24	23	28	97
4	19	18	24	20	81
5	27	25	23	18	93
6	21	22	17	23	83
7	13	20	24	27	84
—	159	165	167	162	653

B. 1880-89.

Days of and following the Moon's Changes.	Last Quarter.	New Moon.	First Quarter.	Full Moon.	Total.
1	29	24	34	27	114
2	28	27	25	23	103
3	25	21	31	21	98
4	26	27	17	22	92
5	24	18	26	20	88
6	18	17	16	22	73
7	27	12	28	15	82
—	177	146	177	150	650

PROVISIONAL AID TO THE STUDY OF THE TASMANIAN MOLLUSCA.

BY R. M. JOHNSTON, F.L.S.

The student of Conchology in Tasmania labours under many disadvantages, owing to the circumstance that the *descriptions* of the various species inhabiting our waters are scattered widely in various publications of Europe and America, while nearly half of the number of the principal *type species* are deposited in foreign museums, and are therefore inaccessible for purposes of reference to local students.

Before we can rest satisfied with the existing classification of many species there is much careful work to be done; for it is well known that the specific descriptions of the earlier distinguished collectors who accompanied expeditions to our seas, are often too meagre to satisfactorily distinguish or separate them from many allied distinct species subsequently discovered. Such accidental collections, too, very naturally contain many forms belonging to widely variable species, and the individuals, of necessity taken by them as types, do not always present the most suitable characters which would serve to distinguish the central type of a widely variable species, and hence the local observer, unable to refer to original types described, is often puzzled or uncertain in his determinations.

It would be well, therefore, to follow the example of New Zealand, in making up a duplicate collection of our shells as complete as possible, and thereafter submit one of them to a well-known European authority like Ed. Von Martins, who would critically examine and compare them with original types in European collections, and submit a critical report for the guidance of local workers. Such a course has already been adopted by New Zealand under the guidance of Professor Hutton, one of the ablest authorities, and certainly one of the most energetic naturalists in Australasia; an example which Tasmania would do well to follow. If Messrs. Legrand, Petterd and Beddome, who have so ably worked in this branch of science in Tasmania, and who possess the best local collections, were to engage in a work of this kind under the auspices of the Royal Society of Tasmania, I am satisfied that the very best results would be attained, and we would then prepare the way for the publication of a work on Tasmanian Mollusca that we could place thorough dependence upon.

It will be observed that although the whole of the 716 known species contained in the list prepared by me were described by over 75 distinct authors at different times and in various publications, yet the greater half (384) were described by five persons, and among these the Rev. J. E. Tenison-Woods alone described 212 species, or nearly a third of the whole. Following next in order to the work of this gifted naturalist last named (whose death, recently, is a loss which all Australasians most deeply deplore), come the names of Lamarck, Reeve, Sowerby, Petterd, Cox, Deshayes, Brazier, Quoy, A. Adams, Gray, Beddome and Angas, all of whom score double figures as regards the number of species described by them respectively.

My own contributions to local Conchology hitherto have been mainly confined to the Fossil Mollusca, although I have been enabled to give the results of long extended observations, and have added 9 new species to the list, in various papers contributed at different times to this Society. Taking the names of Tenison-Woods, Petterd, Cox, Brazier, and Beddome, as local workers, we have some reason to be proud of their accomplishments, for although later in the field, and only numbering 5 out of the 75 authors of species, they have between them described nearly half the number of all the known Tasmanian species.

The labours of the Rev. J. E. Tenison-Woods, F.L.S., etc., deserve special reference, for his writings in all branches of Australasian Natural History are so numerous and valuable that they form in themselves a considerable library. Apart from his many works published in the proceedings of kindred societies in Australia and New Zealand, his interesting volume published many years ago on the Geology of South Australia, and his fine work on the Fishes and Fisheries of New South Wales, he has contributed no less than 31 important communications to the Royal Society of Tasmania, four of which form the chief source of our information concerning the marine and fresh water shells of this Island.

Nor must we forget the labours of another local worker, who although not appearing among the authors of species, has perhaps done more for the science of Conchology in this island than any other single person. I refer to Mr. W. Legrand. This indefatigable naturalist may truly be regarded as the Pioneer of Conchology in Tasmania. He, assisted by Dr. Cox and Mr. Brazier, published the first really important work on Tasmanian Conchology in the year 1870 (Monograph of Tasmanian Land Shells), which afterwards formed the principal part of Mr. Petterd's later monograph on the same subject, published in the year 1878. Nor were Mr. Legrand's labours confined to the land shells. For many years he was the only person who possessed an extensive knowledge of our local mollusca; and such was his enthusiasm and industry in the investigation of the Conchology of Australia generally, that Mr. Woods regarded his collection in the year 1875 to be the "finest in the southern hemisphere;" and writing in acknowledgment of the great services which he rendered to himself in the preparation for his census of Tasmanian shells, published in 1877, by generously placing at his disposal the whole of his fine collection, and by affording him the greater benefit of his vast store of local information, he refers to Mr. Legrand's monograph in the following terms:—"Within the last few years Mr. W. Legrand has published a monograph of all the (then) known land shells, accompanied with extensive notes on the habits, and very excellent figures of the newer species. What gave the work a greater value, was that it was for the most part privately printed by the author. The whole of the work being done by his own hand."

Next in order of time to Mr. Legrand comes Mr. Petterd. Mr. W. F. Petterd, C.M.Z.S., is a native of Hobart, Tasmania, whose name will ever stand a credit to the land of his birth. Almost self-taught in natural history, he has by natural talent accomplished more and better work than many of the European Naturalists, who have had the advantages of immediate reference to the stored and classified collections of the world's great observers. Mr. Petterd is undoubtedly the "Tam Edwards" of Tasmania. His love for natural history as a youth fortunately attracted the notice of our veteran Conchologist, Mr. Legrand, to whom Mr. Petterd, with many others—myself among the number—owe a lasting debt of gratitude for the kindly help and encouragement always readily bestowed.

Mr. Petterd's keen perception, bright intelligence, and taxidermical skill, combined with a rare facility for depicting the objects which interested his attention by artistic drawings, soon gave him a wide and thorough command of the principal forms of local natural history in Tasmania. Nor were his observations and collections of natural objects confined to his native country. He travelled as an observer widely over Australia, from Cape Howe to the Gulf of Carpentaria, and was one of the early pioneer explorers of New Guinea and the Islands of the Pacific. His splendid collections made in all these regions have largely increased our store of knowledge and have enriched the principal Museums of Europe, Australia and America. As a Conchologist he is best known by his fine "Monograph of the Land Shells of Tasmania," read before this society and published in the year 1879. This work has deservedly obtained for him the widest reputation. His contributions on Conchology to the Royal Society of Tasmania since that time have greatly extended our knowledge, and he is now, I believe, engaged upon an elaborate treatise on the shells of Tasmania, which will in the future be the standard work of reference to Tasmanian students.

The labours of Lieut. C. E. Beddome have also added largely to our knowledge, and his contributions respecting new forms (17 species), brought to light by his extensive dredging investigations, come very close to those of Mr. Petterd. Mr. Beddome has also contributed several interesting papers to this Society on Conchology, and he is now the possessor of one of the finest collections in Australasia. He prepared a splendid classified collection of our shells for the Fisheries Exhibition held in London in the year 1887, for which he was awarded First Prize and a Gold Medal.

Nor must we forget in this place the valuable work of the Rev. H. D. Atkinson, of Circular Head. This gentleman has for many years been a most enthusiastic collector. Some of the most interesting forms contained in the Rev. J. E. Tenison-Woods' "Census," were brought to light by Mr. Atkinson, who was the first person in Tasmania who extended his researches into the deeper waters by means of the dredge. At the time Mr. Woods was preparing his "Census," Mr. Atkinson was the only person in Tasmania who sought for novelties in this way.

The labours of Mr. B. Dyer, of Hobart, Mr. R. Gunn, and Mr. A. Simson, of Launceston, as collectors, are also worthy of special notice in this place.

Since the appearance of the Rev. J. E. Tenison-Woods' Catalogue of Tasmanian Shells, valuable critical emendations have been made by Prof. Tate and Mr. John Brazier, and these have been availed of by me in the preparation of the Classified List attached to this paper. These gentlemen have also largely contributed in the extension of our knowledge of the Mollusca. Mr. Brazier's contributions to our knowledge of the land and fresh water shells are especially extensive.

In the following pages I have given a fairly comprehensive account of the bibliography of the subject, and for the convenience of local students who are not in possession of works of reference, I have added a part devoted to the description of the various families, mainly based upon the late G. W. Tryon's splendid work on "Structural and Systematic Conchology," (April, 1884.) To afford additional facilities to such students, I have also prepared an artificial key to the classes, families, and genera, which I hope will prove to be of service. In the preparation of this key, I have been greatly aided by a similar key prepared by Prof. Hutton for his excellent work on the Conchology of New Zealand, (Manual of the New Zealand Mollusca,) published in the year 1880.

In conclusion, I may add that this contribution can only be considered merely as a provisional aid to students of Tasmanian Conchology; but it is hoped it may serve a useful purpose until such time as a more complete work makes its appearance. No doubt it is possible I have failed to notice recent minor contributions which may have appeared in foreign publications, and in the compilation from so many sources, I may have allowed some errors to creep in, but I think these are few and unimportant, and will not materially interfere with its general usefulness.

ARTIFICIAL KEY TO THE FAMILIES.

I. MARINE UNIVALVES.

GASTEROPODA.

(1.) Shell regularly spiral.

(*a.*) *Shell fusiform, tapering to each end, moderately large.*

Large anterior canal, short, recurved, varices not more than 5	Tritonidæ, viii.
Canal straight, short, varices three or more	Muricidæ, vii.
Canal usually straightish and long, no varix	Fusidæ, ix.
Shell notched in front, ovately fusiform	Buccinidæ, x.
Shell with columella plaited, polished aperture, nearly as long as the shell, narrow	Volutidæ, xii.
Columella plaited, aperture small, narrow, not exceeding half the length of shell	Mitridæ, xiii.
Columella plaited, aperture oblong, whorls cancellated, last one inflated	Cancellaridæ, xvii.
Shell small, inner and outer lip crenulated interiorly	Columbellidæ, xvi.
Shell small, somewhat ventricose and rugose, inner lip with a posterior shining callosity, or blunt dentiform plait, anterior canal short, reflected truncate	Nassidæ, xi.

(*b.*) *Shell convolute, the aperture nearly as long as the shell.*

*Spire moderate.

Spire and columella lip covered with enamel, shining	Olividæ, xv.
Small, collumela plaited, outer lip thickened in middle	Marginellidæ, xiv.
Small, columella plaited, aperture, rounded in front	Tornatellidæ, liii.

Small, columella plaited or toothed, spire short	Auriculidæ, lxiv.
**Spire very short.	
Aperture with a recurved canal	Cassididæ, xxii.
Shell inversely conical	Conidæ, xx.
*** Spire none.	
Oval, aperture narrow	Cypræidæ, xxi.
Shell cylindrical, small	Cylichnidæ, liv.
Small, white, pellucid, last whorl expanded	Philinidæ, lii.
Moderate or large, inflated	Bullidæ, lv.
Like *Bullidæ*, shell thin, *flexible*	Lophocercidæ, lvi.

(c.) Shell turreted, elongate or subulate.

Outer lip indented near the suture, canal long and straight	Pleurotomidæ, xix.
Shell elongated, polished, richly coloured, shelly operculum	Phasianellidæ, xliii.
Whorls ribbed, sutures deep	Scalaridæ, xxvi.
Aperture channeled in front, subulate	Cerithiidæ, xxxiv.
Aperture with an oblique notch in front	Terebridæ, xviii.
Shell awl-shaped, spirally striate, aperture rounded	Turritellidæ, xxviii.
Very small, milk white, polished	Eulimidæ, xxx.
Very small, slender, many whorled, whorls plaited	Turbonillidæ, xxxi.
Very small, aperture oavte, columella truncate	Planaxidæ, xxxiii.
Very minute, elongate, whorls flattish, covered with brownish epidermis	Rissoeliidæ, xxxv.
Very small, aperture entire, often umbilicated; columella smooth	Part Rissoidæ, xxxvi.

(d.) Shell globular or turbinated.

Polished, aperature semi-circular	Naticidæ, xxiii.
Aperture semi-circular, columella flat	Neritidæ, xl.
Shell thin, blue	Ianthinidæ, xxvii.
Aperture rounded, not pearly inside	Littorinidæ, xxxii.
Aperture rounded, pearly inside, operculum horny	Trochidæ, xlv.
Like Trochidæ, but with shelly operculum	Turbinidæ, xliv.

(e.) Shell conical, with a flat base.

Shell not pearly inside, umbilicated	Solariidæ, xxv.
Shell not pearly inside, not umbilicated	Littorinidæ, xxxii.
Shell pearly inside, lip without slit	Trochidæ, xlv.
Shell pearly inside, lip perforated, or with a slit	Pleurotomariidæ, xlvii.
Base with a half cup shaped shelf or plate, apex sub-central	Calyptræidæ, xxiv.

Shell depressed, lenticular	Rotellidæ, xlii.

(f.) Shell oval shaped.

Interior with a shelly process	Calytræidæ, xxiv.

(g.) Shell depressed or ear shaped.

Shell depressedly turbinate, umbilicated	Liotiidæ, xli.
Shell ear shaped, thin, fragile, pellucid	Naticidæ, xxiii.
Shell ear shaped, nacreous not perforated	Stomatellidæ
Shell ear shaped, nacreous perforated with holes	Haliotidæ, xlviii.

(2.) Shell irregularly spiral.

Aperture rounded, entire, or with a longitudinal slit	Vermetidæ, xxix.

(3.) Shell flat or simply conical.

Conical, curved anterior, margin notched or the apex perforated	Fissurellidæ, xlix.
Conical or depressed, neither notched nor perforated	Patellidæ, l.
Like Patella, but having a projection formed over a siphonal groove on right side	Siphonariidæ, lxvii.
Shell small, translucent trigonal	Aplysiidæ, lvii.

(4.) Shell multivalve.

Shell composed of eight separate imbricating plates	Chitonidæ, li.

CLASS SCAPHOPODA.

(5.) Shell tube-like, tapering posteriorly	*Dentaliidæ*, lxviii.

(II.) MARINE BIVALVES.

CLASS PELECYPODA.

(A.) Bivalves cemented to or contained within a shelly tube.

Shell either small, equilateral, cemented to the lower end of a shelly tube, umboes alone visible, as in *Aspergillum*, or wholly contained within a tube as in *Gasterochæna*	Gastrochænidæ, lxix.

(B.) Bivalves not cemented or contained within a shelly tube.

(1.) *Dorsal margin protected by one or more accessory valves.*

Shell gaping at both ends, thin, brittle white, very hard. Borers	Pholadidæ, lxxi.

(2.) *Bivalves lacking accessory valves.*

(a.) Two adductor impressions, nearly equal.

* Pallial line *sinuated.*

†Ligament external.

Very long, sub-cylindrical, straight ends gaping	Solenidæ, lxxii.
Equivalve thick, gaping	Saxicavidæ, lxxiii.
Shell rounded, beaks turned forward; hinge teeth 2—2	Semelidæ, lxxviii.
Compressed, thin ligament, anterior	Tellinidæ, lxxix.
Shell rugosely striated and ribbed, sinus profound	Petricolidæ, lxxxii.
Three diverging teeth in each valve	Veneridæ, lxxx.
†† Ligament internal.	
Small, thick, produced behind	Corbulidæ, lxxiv.
Thin, cartilage with a free ossicle	Anatinidæ, lxxv.
Ligament in a triangular pit; two cardinal teeth	Mactridæ, lxxvi.
Ligament in a triangular pit; one cardinal tooth	Paphiidæ, lxxvii.
Hinge with many teeth in a line, inside pearly	Nuculidæ, xcii.
** Pallial line *simple*.	
† Ligament external.	
Trigonal, radiately ribbed, inside pearly	Trigoniidæ, xci.
Radiately ribbed, cordate not pearly	Cardidæ, lxxxiii.
Thin, orbicular, white, divaricating striæ	Lucinidæ, lxxxv.
Inequivalve thick, attached by left umbo	Chamidæ, lxxxiv.
Sub-orbicular, smooth, ligament double submarginal. No lateral teeth	Ungulinidæ, lxxxvi.
Minute, thin, sub-oval, usually transparent	Erycinidæ, lxxxvii.
†† Ligament internal.	
Large, solid, oblong, ventricose, attenuate behind, smooth or concentrically furrowed	Crassatellidæ, lxxxviii.
Roundly ovate, strongly radiately ribbed	Astartidæ, lxxxix.
Hinge, many teeth in a line, not pearly	Arcidæ, xciii.
Hinge, many teeth in a line, pearly inside	Nuculidæ, xcii.

(*b*.) Two adductor impressions, very unequal, umbones anterior.

Shell equivalve, oval or elongated, inside pearly	Mytilidæ, xciv.
Shell large, equivalve wedge shaped, thin, brittle	Pinnidæ, xcvi.
Shell small, eared, thin, transparent, or having pearly interior, often gaping	Aviculidæ, xcv.

(*c.*) One adductor impression.

Shell irregular, radiately ribbed, spiny, usually 2 hinge teeth in each valve	Spondylidæ, xcvii.

Shell inequivalve, upper one flat, no teeth	Ostreidæ, ci.
Shell thin, perlaceous, with a deep notch or hole in the inferior valve, attached	Anomiidæ, c.
Shell eared, sub-orbicular, radiately ribbed	Pectinidæ, xcviii.
Shell eared, white, gaping at the sides, equivalve often minute	Limidæ, xcix.
(C.) Shell globular, three lobed, concentrically striated, open in front and behind, lodged at the extremity of a shelly lined tube or burrow	Teredidæ, lxx.

CLASS BRACHIOPODA.

(D.) Shell round or oval, perforated near or at the apex. minutely punctate	Terebratulidæ, cii.

(III.) LAND AND FRESH WATER MOLLUSCS.

(A.) Land Slugs, or Snails; shell none, or rudimentary.

Shell rudimentary, a calcareous plate concealed under the mantle, jaw of animal without ribs	Limacidæe, lxi.
Shell rudimentary, often composed of a few calcareous grains, jaw of animal strongly ribbed	Arionidæ, lxii.

(2.) *Land Snails, with shell more or less spiral and fully developed.*

Shell small, oval, with short spire, fragile, whorls few, rapidly enlarging, resembling some fresh water *Lymnæa*	Succineidæ, lxiii.
Shell usually thin, corneous, transparent, plaits spiral, of few rapidly enlarging whorls, animal too large to entirely enter	Vitrinidæ, lviii.
Shell of variable form, large or very minute, smooth, rugose, striated ribbed or cancellate, sometimes pilose, orbicular planoid convex, planorboid trochiform (Helix Launcestonensis) sub-turriculated or short—Helix—shell large, oblong, spiral (Bulimus)	Helicidæ, lix.
Shell minute, multispiral, cylindrical, with obtuse summit, pupiform, aperture small, usually contracted by internal teeth or lamellæ. Whorls reversed in local example	Pupidæ, lx.

(B.) Fresh water or sub-aquatic, nearly all more or less covered with a dark brownish epidermis.

(a.) Spiral univalves.	
* Sub-aquatic.	
Shell minute, cylindrical apex, truncated whorls, striated transversely—margins of sea shore	**Truncatellidæ, xxxix.**
Shell, smooth, elongated, perforated, whorls very convex, aperture round, peristome slightly expanded or reflected, apex frequently decollate. (Pomatiopsis)	Part Rissoidæ, xxxvi.
** Aquatic.	
(1.) † *Shell very minute, depressed, conical or umbilicated*	Valvatidæ, xxxviii.
(2.) †† *Shell very minute*, 4 to 6 whorls, *sub-umbilicated*, elongate, ovate or pupiform (Bithynella), turbinately ovate, inner lip more or less reflected. (Beddomeia)	Part Rissoidæ, xxxvi.
Shell minute, turbinately elongate, sub-perforate. (Hydrobia.)	
(3.) ††† Shell small, globosely rounded, ovate imperforate, inner lip thickened. (Brazieria.)	
(4.) Shells found in or near brackish water. Small, minute, globosely conical, sharp lip	Assiminiidæ, xxxvii.
Shell, moderate, sub-globose, banded	Amphibolidæ, lxvi.
Elongate, minute, pyramidal pointed spire, flattish whorls. (Tatea.)	Rissoellidæ, xxxv.
(5.) Shell moderate size or minute with sharp spire more or less acuminate; columella lip with oblique plait above, oval, oblong, corneous translucent, dextral. (*Limnæa.*)	Part Limnæidæ, lxv.
Sinistral. (*Physa.*)	
Shell very minute, discoidal bi-concave. (*Planorbis.*)	
(b.) Non-spiral, pateliform or conical, base, partly closed by a flat shelf, leaving a semi-lunar aperture, apex inclined to the right. (*Gundlachia.*)	Part Limnæidæ, lxv.
Shell aperture simple, entire, conical, limpet-shaped, sometimes radiately ribbed. (*Ancylus.*)	

(c.) Bivalve shells minute, ovate, thin, olive or white. (Pisidium) Minute, sub-quadrate, thin, yellowish. (Sphærium or Cyclas.)	Cyrenidæ, lxxxi.
Shell, large, oblong-oval, blackish epidermis; umboes eroded, pearly inside	Unionidæ, xc.

LIST OF THE VARIOUS AUTHORS WHO HAVE DESCRIBED MORE THAN ONE LOCAL SPECIES, ARRANGED ACCORDING TO THE ORDER OF THEIR IMPORTANCE LOCALLY.

		Species Described. No.
1.	Tenison-Woods	212
2.	Lamarck	59
3.	Reeve	39
4.	Sowerby	37
5.	Petterd	37
6.	Cox	29
7.	Deshayes	23
8.	Brazier	19
9.	Quoy	18
10.	A. Adams	18
11.	Gray	17
12.	Beddome	17
13.	Angas	15
14.	Crosse	10
15.	Linne	9
16.	Johnston	9
17.	Adams and Angas	9
18.	Swainson	9
19.	Pfeiffer	8
20.	Quoy and Gaim	8
21.	Tate	5
22.	Chemnitz	5
23.	Dunker	5
24.	Martyn	4
25.	Born	3
26.	H. and A. Adams	3
27.	Gmelin	3
28.	Philippi	3
29.	Hinds	3
30.	Kiener	3
31.	Stutchbury	3

32. Hanley	3
33. Frauenfield	2
34. Menke	2
35. Mueller	2
36. All others	63
Total	716

CLASSES, FAMILIES AND GENERA.

DESCRIPTIVE ACCOUNT OF THE VARIOUS CLASSES, FAMILIES AND GENERA OF MOLLUSCS INHABITING TASMANIA, SYSTEMATICALLY ARRANGED ACCORDING TO TRYON, ("STRUCTURAL AND SYSTEMATIC CONCHOLOGY, 1884."

NOTE.—The Roman numbers refer to the number of the family, and the Arabic numbers in brackets to the number of the species; both arranged in consecutive order in the systematic list.

CLASS CEPHALOPODA.

Cuttle Fish, Squids, Nautili, etc.

Head large, separate from the body; eyes large, lateral; ears developed; mouth with two *horny or shelly beak-like jaws* with fleshy lips, and surrounded by *eight or ten fleshy arms or numerous* tentacles, furnished with an entire or slit tube, used in locomotion, which is usually directed backwards in swimming.

SYNOPSIS OF FAMILIES.

A. Order DIBRANCHIATA.

Animal breathing by a *single pair* of symmetrical branchiæ or gills; *eyes sessile; shell internal or none; mandibles horny*; arms with suckers.

Sub-Order OCTOPODA.

Arms, eight; no shell, (the so-called shell of the argonaut is the egg nest of the female.)

	Family
Sessile ...	Octopodidæ
Suckers slightly *pedicelled*; female having two of the upper arms expanded into broad webs, one of which secretes an egg nest (nautiliform shell.) ..	Argonautidæ

(i.) Family OCTOPODIDÆ.

Mantle supported by fleshy bands; no ceptralic aquiferous pores; arms subulate, elongated, more or less united by webs, their *suckers sessile.*

SYNOPSIS OF GENERA.

(1.) *Arms with two rows of suckers*	*Genus.*
(*a.*) *Body not finned.*	
Body *rounded*; arms long; suckers sessile; *third right arm of male* hectocotylised	Octopus (1.)
Differs from Octopus in having a small aquiferous system, consisting of a bag with a small pore at its lower edge upon the web between each arm	Cistopus (—)
Body *oval,* wider than head; arms short; cups with narrowed bases; third *left* arm hectocotylised	Scæurgus (—)
Arms united by a web nearly to the ends	Alloposus (—)
(*b.*) *Body Finned.*	
Body like Octopus, but finned; arms with two rows of suckers	Pinnoctopus (2)
(2.) *Arms with a single row of suckers*	
(*a.*) *Not Finned.*	
Body rounded, without fins; third right arm hectocotylised	Eledone (—)
More gelatinous than Eledone; suckers smaller, less developed	Bolitæna (—)
(6.) *Finned.*	
Body with two transverse medial fins; mantle united to the head nearly all round by a conical band; arms united by a web nearly to the tips	Cirroteuthis (—)
(3.) *Arms with three rows of suckers.*	
Body not finned.	Trixaxeopus (—)

(ii.) Family ARGONAUTIDÆ.

Mantle supported by two buttons fitting into grooves at the base of the siphuncle; the two upper or dorsal arms (in the females only) expanding into broad webs at their extremity, from which an egg-nest (shell) is secreted; cups slightly pedicelled; a pair of aquiferous pores at the upper hinder angle of the eye.

	Genus.
Characters those of the family; the third right arm of the male is hectocotylised; shell thin, translucent; nautiliform, white, usually two nodose keels at periphery	Argonauta (3)

SUB-ORDER DECAPODA.

Ten arms, of which ***eight are sessile,*** and ***two*** (longer) ***tentacular,*** shell internal.

(1.) ***Internal shell horny.***

(*a.*) Eyes ***covered by skin***; mostly littoral species.

	Family
Body long; tentacular arms, partially retractile	Loliginidæ
Body short; tentacular arms, completely retractile	Sepiolidæ

(*b.*) Eyes ***naked***; Pelagic species.

Body long, cylindrical; arms or tentacles armed with ***hooks***	Onychoteuthidæ
Body long, cylindrical; arms with ***suckers*** only	Ommatostrephidæ

(2.) ***Internal shell calcareous.***

(*a.*) Shell blade like	Sepiidæ
(*b.*) Shell forming a series of chambers transversed by a siphon	Spirulidæ

(iii.) Family LOLIGINIDÆ.

Body rather long; buccal skin sometimes armed with suckers; tentacular arms only partially retractile; fins lateral, terminal; inner shell or ***gladius as long as the back.*** (Calamary.)

	Genus.
Body long, with posterior rhombic fins united behind; mantle supported by a cervical ridge, and by cup-like cartilages on the base of the funnel or siphon; siphon valved, attached by bands to the head; arms with two rows of suckers, provided with ***horny dentated rings***; tentacular arms with ***four rows*** of suckers on their clubs; fourth	

	Genus.
left arm hectocotylised at its extremity; gladius feather-like, its shaft keeled on the ventral side	Loligo (—)
Body rather long or oval, with small lateral fins extending its entire length; siphon attached to the head by muscular bands; buccal skin with *seven* projections covered with suckers; a strong wrinkle behind the eyes; otherwise like *Loligo*	Sepioteuthis (6)

(iv.) Family Onychoteuthidæ.

Body long, cylindrical; mantle supported by cartilagineus projections; eyes with a lachrymal sinus; arms or tentacles *armed with hooks*; siphon with or without bands and valve; gladius or shell generally lancet form, with *end-conus*

	Genus.
Arms with two rows of suckers; rings not toothed; tentacles thick; *clubs armed with two rows of strong hooks*; bases of the same also strongly hooked; gladius or shell lancet form, with a conical commencement	Onychoteuthis (4)

Family Ommatostrephidæ.

Arms *short*, with two rows of suckers; tentacles short, not retractile; the clubs armed with *four rows of suckers;* siphon valved, fastened to the head by bands; shell lancet form, with a hollow end, conus	Ommatostrephe (5)
Club arm armed with a combination of smooth-rimmed suckers and tubercles	Architeuthis (—)

(A gigantic group of cephalopods.)

(—) Family Sepiidæ.

Eyes covered by skin; littoral. Body oval, with long lateral fins, uniting behind; mantle supported by *cartilaginous tubercles*, fitting into sockets on the neck and siphon; arms with suckers; tentacular arms entirely retractile; siphon valved; shell (cuttle bone, sepion, or sepiostaire,) broad, flat, thickened internally by numerous plates, terminating behind in a hollow, imperfectly chambered, apex or mucro, without connecting siphon.

	Genus.
A lid-like fold under the eyes with lachrymal openings over them; six aqueous pores in the buccal membrane; arms short; tentacles long, suckers long, pedunculated; siphon with very large valve; fourth left arm hectocotylised to its base, (one or two species undetermined abundant in Tasmanian waters)	Sepia (—)
Differing from Sepia by the sessile arms having only two rows of suckers	Hemisepius (—)

(v.) Family SPIRULIDÆ.

Animal, body oblong, with minute terminal fins; mantle supported by a cervical and two ventral ridges and grooves; arms with six rows of minute cups; tentacular arms elongated; siphon valved; *shell* laxly spiral, pearly whorls on the same plane, not in connection, chambered; chambers connected by a ventral siphon, invested by a series of cone-shaped tubes, one for each chamber; shell is placed vertically in the end of the body, and is held in place by side flaps of the mantle.

	Genus.
Characters same as those of family	Spirula (7)

(B.) TETRABRANCHIATA.

Animal breathing by *two pairs* of symmetrical branchiæ; *eyes pedunculated*; mandibles *shelly*; arms very numerous, *without suckers*; shell external, chambered; capable of containing the animal.

(vi.) Family NAUTILIDÆ.

Septa simply curved, concave on the outer face; sutures simple, or undulate, or lobed; mouth simple; siphonal opening nearly central; shell often banded with colour, pearly inside. (Six living, and over 2,000 fossil species.)

Shell involute, discoidal few-whorled; septa concave, simple; siphuncle nearly central. Dist.—Tropical seas. Australia and Tasmania	Nautilus (8)

CLASS GASTEROPODA. (vii.-lxvii.)

Head distinct, usually furnished with eyes and tentacles; body mostly protected by a *spiral* or *conical univalve shell*; lower surface of animal developing a thickened, expanded, creeping disc or foot.

SUB-CLASS PROSOBRANCHIATA. (vii.-li.)

Sexes separate in different individuals. *Mostly marine animals*, provided with a shell and generally an operculum, embraces at least all operculated molluscs. Animals breathe by *gills or branchiæ.*

SUB-CLASS OPISTHOBRANCHIATA. (lii.-lvii.)

Marine slugs breathing by *arborescent or fasciculated branchiæ*, more or less exposed on back and sides posteriorly; a large division shell less, another possessing a spiral, conical or lamellar shell partly concealing branchiæ and itself *more or less concealed by mantle lobes. Sexes united.*

SUB-CLASS PULMONATA. (lviii.-lxvii.)

Mostly terrestrial (land shells), a portion being fluviatile (fresh water), usually provided with a *shell without operculum*, breathing air by the *simplest form of lung*, a pouch with external opening, lined with a net work of respiratory vessels. Sexes united in the same individual.

CLASS SCAPHOPODA. (lxviii.)

Shell or *hollow cylinder*, straight or curved without spire, open at both ends. Head rudimentary; foot vermiform, lobulate; nervous system simplified, resembling that of the pelecypods or lamellibranchs.

CLASS PELECYPODA. (lxix.-ci.)

(*Lamellibranchiata* Conchifera, Bivalves.)

No head nor eyes. Animals breathing by lamellæ, two on each side, mostly diæcious head with two chambers;

nervous system, gills with three principal pairs of ganglia. No sexual union, fertilisation being accomplished by the surrounding water containing the male element. Shell composed of two valves hinged together, but occasionally (Barnea) with smaller supernumerary pieces about the hinge.

Order SIPHONIDA. (lix. to lxxxix.)

Animal *with siphons*, and mantle margins more or less closed; comprises most of the marine branchiæ, including a large portion of the old order *Dimyaria*—having *two well developed muscular impressions*.

	Sub. order.
Siphons *long*, partly or wholly retractile; the pallial impression upon the inside of valve *with a sinus*.	Sinupalliata (lxix. to lxxx.)
Siphons *short, not retractile*; pallial impression *simple without sinus*.	Integripalliata (lxxxi. to lxxxix.)

Order ASIPHONIDA (xc.-ci.)

No siphons; pallial impression *without sinus*; mantle margin open.

	Sub. order.
Two muscular impressions equally distinct; mantle margins open or closed behind.	Homomyaria (xc. to xciii.)
Two unequal muscular impressions; *posterior* impressions *large*, anterior impression *very small*; frequently *inequivalve*.	Heteromyaria (xciv. to xcvi.)
A single posterior or sub-central adductor muscle and impression *only*	Monomyaria (xcvii. to ci.)

FAMILIES, GENERA AND SUB-GENERA.

(vii.) Family MURICIDÆ.

Shell spiral; turriculated with an *anterior* canal; the whorls thickened by varices or nodules at each rest period in its growth.

Genus MUREX. Linn. (9-11.)

Shell ovate or oblong; spire prominent; whorls convex crossed by three or more continuous varices; aperture ending below in a canal, which is generally partly closed.

Genus Urosalpinx. Stimpson. (12.)

Syn Adamsia, Agnewia.

Shell fusiform; not variced; longitudinally ribbed or undulated and spirally striated; aperture with a short canal; outer lip dentate, lirate within. Operculum semicordate, nucleus marginal.

Genus Typhis. Montfort. (13.)

Shell ovate or oblong, with *numerous projecting hollow tubular spines* between the three varices; aperture nearly round, produced in front into an *enclosed siphonal canal*; operculum ovate with apical nucleus.

Genus Trophon. Montfort. (14-22.)

Shell large, broadly fusiform, usually shouldered and umbilicate; with numerous lamelliform or laciniated varices, spire prominent; aperture ovate, lips thin; canal open, *usually turning to the left*; shell *white* without, but often dark within.

Genus Purpura. Bruguiere. (23-28.)

Syn.—Microstoma. Thais.

Shell oblong-oval, *last whorl large*; spire usually short; columella flattened; aperture ovate, large, terminating in a very short oblique channel, or notched; outer lip simple. *Dist.*—Low water to 25 fathoms.

(viii.) Family Tritonidæ.

(Shell with varices which are either few and irregularly distributed, or form a continuous row crossing the whorls on opposite sides.)

Genus Triton. Montf. (29-33.)

Syn.—Tritonium, Charonia, Aquilus, Lampusia, Ranularia

Shell oblong with prominent spire; whorls with a few remote non-continuous varices; columella rough or smooth; canal recurved; outer lip crenate or denticulate; operculum ovate with sub-marginal nucleus. *Dist.*—Low water to 50 fathoms.

Genus Ranella. Lam. (34-36.)

Shell ovate or oblong, compressed; varices two, continuous, one on each side; *columella arcuated, ridged or crenulate*; aperture oval; outer lip crenated; canal short, recurved; operculum ovate, horny, with lateral nucleus, *Dist.*—Reefs and deep water.

Family ix. Fusidæ.

(Shell more or less spindle-shaped, *without varices*; the lip of aperture not thickened.)

Genus Fusus. Lamarck. (37-42.)

Shell fusiform, not variced; spire long, acuminate, many whorled; *columella smooth, without plaits*; aperture ovate, usually striate within; outer lip simple; *canal long and straight*; operculum ovate; acute, with apical nucleus; yellowish brown; sometimes with red brown strigæ or spots, never branded. *Dist.*—World-wide.

Genus Fasciolaria. Lamarck. (43-45.)

Shell fusiform; spire acuminate; aperture oval-elongate, outer lip internally crenate; columella smooth, *with a few oblique plaits*; canal moderate, nearly straight. *Dist.*—World-wide.

(x.) Family Buccinidæ.

(Columella generally without folds or plications.)

Genus Siphonalia. Adams. (46-48.)

Shell ovately fusiform, sometimes variegately coloured, thin with very thin fugacious epidermis; last whorl ventricose, shouldered usually nodosely, plicate and spirally ribbed; aperture oval; outer lip thin; columella smooth; *canal rather short, twisted*; operculum ovate, with apical nucleus. *Dist.*—Japan, California, Australasia.

Genus Cantharus. Bolten. (49.)

Syn. Tritonidea.

Shell bucciniform, more or less ventricose in the middle, narrow anteriorly; *spire and aperture nearly equal*; columella generally with a few transverse ridges; outer lip internally crenated with a superior siphonal canal; operculum ovate, with apical nucleus.

Genus Pisania. Bivona. (50-51.)

Shell oblong, with prominent spire; whorls smooth or spirally striated; canal very short; outer lip thickened and crenated; operculum ovate, with apical nucleus. *Dist.*—West Indies, Mediterranean, Philippines, Australasia.

Genus Cominella. Gray. (52-59.)

Shell bucciniform, marked or spotted, *covered with an epidermis*; spire short, acute; last whorl large, ventricose, with a *posterior depressed groove at the suture, producing a contraction at the hind part of the outer lip*; operculum with apical nucleus. The sub-genus *Josepha*, T.-Woods, differs from Cominella in possessing a plait upon the columella. *Dist.*—Cape, Australasia.

Genus EBURNA. Lam. (60.)

Shell ovate-oblong, thick, porcellanous, under a thin epidermis; *deeply umbilicated*; spire acuminated; whorls more or less convex, *suture more or less channeled*; columella arcuated; callous posteriorly; aperture oval, inner lip spreading, *often covering the umbilicus* in the adult; outer lip simple acute; operculum with apical nucleus. *Dist.*—Red Sea, India, Cape, Japan, China, Australasia.

(xi.) Family NASSIDÆ.

(Base of aperture with a notch or short recurved canal; inner lip callous.)

Genus NASSA. Lam. (61-65.)

Shell small, ovate; ventricose; body whorl variously sculptured; aperture ovate, with a short, reflected, truncated, anterior canal; inner lip smooth; *often widely spread over with enamel*, with a *posterior callosity* or blunt, dentiform plait; outer lip dentated, internally crenulated; margin of operculum, serrate or entire. *Dist.*—World-wide.

(xii.) Family VOLUTIDÆ.

Genus VOLUTA. Linn. (66-72.)

Shell ovate or sub-conical, thick, solid; *spire usually short*; (Shoulder of whorls often angulated, sometimes nodose or spinous, but not so characterised in the Tasmanian living species.) Aperture—extending the *greater length of shell*—long and rather narrow; columella with a callous deposit and *prominently plaited*; lip generally thickened, sometimes sub-reflected. *Dist.*—World-wide, Australia being the chief centre.

(xiii.) Family MITRIDÆ.

Genus MITRA. (73-86.)

Shell fusiform thick; spire elevated; *aperture small*, generally *less than half the length of the shell, narrow*, notched in front; columella *transversely, somewhat obliquely plicate;* outer lip thick, smooth within, not variced externally. *Dist.*—Tropical and sub-tropical; range low water to 80 fathoms.

(xiv.) Family MARGINELLIDÆ.

Genus MARGINELLA. Lam. (88-96.)

Shell smooth, bright; spire short or concealed; aperture obtuse or truncated in front; *columella plaited*; *outer lip* (of adult) *with a thickened marginal varix*; inner margin smooth or crenulate. *Dist.*—Tropical and sub-tropical.

Genus ERATO. Risso. (87.)

Shell obovate, polished; spire short, conical, distinct; aperture linear; *outer lip without varix,* but *thickened towards the middle,* and denticulate within; columella with *distinct plaits at the fore part. Dist.*—World-wide.

(xv.) Family OLIVIDÆ.

(Shells sub-cylindrical, porcellanous, brilliant in colour; columella lip, sutures and spire more or less covered with a callous deposit; outer lip simple, notched below.)

Genus OLIVELLA. Swainson. (97.)

Shell *small,* polished, sub-cylindrical, solid; *spire produced,* acute; suture canaliculate; aperture narrow behind, enlarged anteriorly; columella plicated in front, callous posteriorly; *operculum present,* thin, half ovate with apical nucleus. *Dist.*—N. America, China, Australasia, etc.

Genus OLIVA. Brug. (98.)

Shell oblong, sub-cylindrical, polished; *spire short, conical*; suture canaliculate; *aperture long, narrow,* anteriorly widely notched; columella obliquely plicate; sulcate or striate in front; callous posteriorly; outer lip simple; operculm wanting. *Dist.*—America, Africa, India, Polynesia, Australasia.

Genus ANCILLARIA. (99-101.)

Shell oblong, polished, sub-cylindrical; body whorly, swollen; sutures covered by enamel; aperture broadly effuse below; columella not umbilicated, with a few oblique anterior plaits; basal whorl marked with revolving grooves which terminate occasionally in a slight anterior lip projection or tooth; *operculum generally present, small, ovate, acute. Dist.*—Red Sea, Indian Ocean, Japan, West Indies, Australasia.

(xvi.) Family COLUMBELLIDÆ.

Genus COLUMBELLA. Lam. (102-113.

Shell strombiform, mitriform, or fusiform (usually fusiform, with elevated spire in Tasmanian species), smooth, or longitudinally or transversely ribbed; internal lip excavated in middle, *crenulate or denticulate in front*; outer lip *inflected and internally thickened and crenulate in the middle*. *Dist.*—Mostly sub-tropical. (Oat shell.)

(xvii.) Family CANCELLARIDÆ.

Genus CANCELLARIA. Lam. (114-117.)

Shell ovately fusiform, *cancellated*, reticulated or ribbed; last whorl ventricose; aperture oblong, canaliculate in front; canal short, sometimes recurved; *columella with several large oblique plications*; operculum wanting. *Dist.*—World-wide; range, low water to 40 fathoms (vegetable feeders).

(xviii.) Family TEREBRIDÆ. (Auger Shells.)

Genus TEREBRA. Lam. (118-123.)

Shell *elongate, narrow, turriculate*, solid; whorls flattish, numerous, with superficially impressed sutures; aperture *small, ovate*. Profoundly notched at the base; columella oblique; operculum annular, horny, with apical nucleus. *Dist.*—Mostly tropical.

(xix.) Family PLEUROTOMIDÆ.

Genus PLEUROTOMA. Lam. (124-152.)

Shell turriculated, fusiform, *terminated anteriorly* by a straight canal, more or less prolonged; aperture generally linear-ovate; columella smooth, straight, or sinuous; outer lip *somewhat sinuous, with a notch or slit near the suture*; operculum corneous, annular, not always present. *Dist.*—World-wide; low water to 100 fathoms.

Sub-Genus DRILLIA. Gray.

Turriculated; aperture oval, oblique, about one-third the length of (adult) shell; canal short, twisted; columella lip strongly callous above.

Sub-Genus BELA. Gray.

Shell oval, fusiform; spire produced; canal short; sinus small near the suture; columella flattened; aperture narrowly ovate, nearly half the length of shell; *operculum pointed at both ends*.

Sub-Genus CLATHURELLA. Carp.

Differs from *Mangelia* in the more ventricose form and more evident canal; from *Clavatula* in the emargination of outer lip; from *Bela* and *Daphnella* in texture and sculpture; shell fusiform or turriculate, cancellated surface; columella lip without callosity, except a small posterior tooth; *no operculum;* aperture nearly half the length of (adult) shell.

Sub-Genus DAPHNELLA. Hinds.

Shell fusiform, *thin, fragile, usually striated;* aperture elongated, oval, usually less than half the length of (adult) shell; canal very short. Small and elegant shells, distinguished from *Defrancia* by their elongated body-whorl tenuity and sculpture. No operculum.

Sub-Genus CITHARA. Schum.

Shell fusiform, *polished, longitudinally ribbed*; aperture linear, truncated in front, slightly notched behind; outer lip *margined, denticulate within*: *inner lip frequently finely striate*; no operculum.

Sub-Genus MANGELIA. Leach.

Shell fusiform, mostly longitudinally ribbed; spire elongated, turriculate, accuminate; canal short, more or less truncate; columella smooth; aperture usually fully half the length of shell; sinus near the suture; no operculum.

(xx.) Family CONIDÆ.

Genus CONUS. Lam. (153-157.)

Shell thick, obconic; whorls enrolled upon themselves; spire not elevated or short, smooth or tuberculate; aperture elongate, narrow, margins parallel, truncate at base; outer lip with a slight suttural sinus. *Dist.*—Principally developed in the equatorial region.

(xxi.) Family CYPRÆIDÆ.

(Shell *convolute, enamelled*; *spire concealed*; aperture narrow, channeled at each end; no operculum.)

Genus CYPRÆA. Linn. (158-164.)

Shell ventricose, *convolute, covered with shining enamel*; *spire concealed*; aperture long, narrow, with short canal at each end; *inner lip crenulated;* outer lip *inflected* and crenulated.

Sub-Genus Trivia. Gray.

Distinguished by being striated over the back, frequently interrupted by an impressed dorsal sulcus.

Sub-Genus Cypræ-ovula. Gray.

Pyriform, oval, ventricose. Surface covered with revolving striæ.

Genus Ovulum. Brug. (165.)

Shell ventricose, convolute, *attenuate, and sub-acuminate at both ends*; outer lip of adult thickened and inflected.

Sub-Genus Volva. Bolten.

Distinguished by being ventricose *in middle*, and in having both extremities prolonged into canals.

(xxii.) Family Cassididæ.

Genus Cassis. Lam. (166-170.)

Shell sub-globular or triangular, usually solid, thick (Tasmanian species excepted), last whorl large, varicose; aperture longitudinal, narrow; outer lip *with a thickened, reflected margin, dentate within*; inner lip rugosely plicate; operculum oval, narrow, with median apex. *Dist.*—Mostly tropical and sub-tropical; voracious, living in sandy localities, preying upon bivalve molluscs.

Sub-Genus Semicassis. Klein.

Shell oval, with revolving ribs; spine moderate, sharp.

Sub-Genus Casmaria. H. and A. Adams.

Shell *generally* smooth; *whorls simple or sub-plicate*, spire moderate; inner lip smooth, callous; outer lip margined, smooth or slightly crenulated on the inner edge.

(xxiii.) Family Naticidæ.

(Shell globular or oval; spire, usually short; aperture, semilunar, *without canal* or *anterior notch*; outer lip sharp; *columella callous, more or less reflected over the umbilicus*; operculum pauci-spiral, corneous, or with an exterior calcareous layer.)

Genus Natica. Lam. (171-177.)

Shell sub-globular; spire slightly elevated; aperture half round. A *spiral columella callus entering the umbilicus*. *Dist.*—World-wide.

Sub-Genus MAMILLA. Schum. (RUMA, H. and A. Adams.)

Shell ovate, conic, *rather thin*, with pointed spire; whorls fasciated; mouth *oblong*; inner lip narrow, reflected; umbilicus *not funiculated.*

Genus SIGARETUS. Lam. (178.)

Shell *ear-shaped*, with minute spire, and very large aperture, externally *with revolving striæ*; colour usually white, with sometimes a thin corneous epidermis; operculum minute, horny, sub-spiral. *Dist.*—United States, West Indies, China, Peru, Australasia.

Genus LAMELLARIA. Montagu. (179.)

Shell *ear-shaped*, *thin*, *pellucid*, *fragile*; spire very small; aperture large, patulous; inner lip receding; no operculum. *Dist.*—Norway, Great Britain, Mediterranean, New Zealand, Philippines.

(xxiv.) Family CALYPTRÆIDÆ.

(Shell *limpet-like*, with the apex more or less spiral; interior simple, or divided by a shelly process or plate, variously shaped, to which the adductor muscles are attached.)

Genus INFUNDIBULUM. Montfort. (180.)

Syn.—Trochita, Clypeola, Trochella.

Shell conic trochiform, spiral; summit central; whorls convex, plicate not umbilicated; aperture large, containing a spiral, transverse lamina or plate, extending obliquely from the centre to the outer margin of the shell. *Dist.*—Mostly tropical and sub-tropical.

Genus CALYPTRÆA. Lam. (182.)

Shell conical, more or less angular, with sub-central subposterior sharp apex; aperture basal, with a central lamina, half-cup shaped, attached to apex and open in front. *Dist.*—World-wide.

Genus LEGRANDIA. Beddome. (181.)

Shell *emarginuliform*; internal plate like *Crepidula*; radiately ribbed; *front edge fissured. Dist.*—Tasmania.

Genus CREPIDULA. Lam. (183-184.)

Shell oval, *limpet-like*, with a posterior generally lateral spiral apex; interior with a shelly plate covering its posterior half. *Dist.*—World-wide.

Genus HIPPONYX. Defrance. (185-187.)

Shell thick, obliquely conical, *non-spiral*; apex somewhat posterior and curved backwards; *muscular impression, horse-shoe shaped*; base of attachment shelly. *Dist.*—Almost world-wide.

Sub-Genus AMALTHEA. Schum.

Like Hipponyx, but *without shelly* base; impression *crescent-shaped.* This form is usually found attached to living shells.

(XXV.) Family SOLARIIDÆ.

(Shell *orbicular, depressed, or trochiform*; aperture generally angular; umbilicus usually wide and deep; operculum corneous, spiral.)

Genus SOLARIUM. Lam. (188-189.)

Shell depressed, conical, angular at periphery; aperture, sub-quadrangular, lip simple; umbilicus wide, spiral, its margins crenulated; operculum horny, sub-spiral. *Dist.*—Tropical, world-wide.

Genus ADEORBIS. S. Wood. (190.)

Shell *depressed*, orbicular, widely umbilicated; *whorls not numerous*, smooth or striate, the last somewhat angular; *aperture rounded*, the outer lip arcuate, simple, sharp; operculum shelly, sub-spiral. *Dist.*—West Indies, China, Australasia.

(XXVI.) Family SCALARIDÆ.

Genus SCALARIA. Lam. (191-202.)

Shell mostly white and lustrous; turreted; many whorled; whorls round, sometimes separate, *ornamented with numerous transverse ribs;* aperture round; *peristome continuous;* operculum horny, few whorled. *Dist.*—Mostly tropical.

Sub-Genus CROSSEA. A. Adams.

Shell *turbinate, umbilicated, white;* whorls convex, *cancellated, simple or with varices;* aperture roundish, anteriorly angular, somewhat produced and canaliculate; umbilicus surrounded and narrowed by a callus. Occurs also fossil in Australia and Tasmania, in rocks of Eocene age.

(xxvii.) Family IANTHINIDÆ.

Genus IANTHINA. Lam. (203-205.)

Shell thin, *translucent, trochiform or globular-turbinate; nucleus minute, styliform, sinistral;* whorls few, rather ventricose; aperture four sided; columella tortuous; lip thin, notched at the outer angle; base of the shell deep violet; spire nearly white. *Dist.*—Pelagic in Atlantic and Pacific Oceans.

(xxviii.) Family TURRITELLIDÆ.

Genus TURRITELLA. Lam. (206-210.)

Shell *elongated, awl-shaped,* many whorled, with revolving striæ; *aperture rounded;* operculum, many whorled, with a fimbrated margin, usually whitish or brownish, with sometimes red-brown spots or flames. *Dist.*—World-wide, ranging from Laminarian Zone to 100 fathoms.

(xxix.) Family VERMETIDÆ.

(G.) Shell (adult) *irregularly spiral, or contorted tubular;* operculate.

Genus VERMETUS. Adamson. (211.)

Shell irregularly spiral, adult stage, or contorted, tubular, operculate. *Dist.*—Tropical and sub-tropical. World-wide.

Genus SILIQUARIA. Brug. (212-213.)

Shell tubular: spiral at first, afterwards irregular; *tube with a continuous slit;* operculum spiral.

(xxx.) Family EULIMIDÆ.

(*Shell turriculated or turbiniform, smooth, milk white, polished;* aperture oval or rounded, sometimes angular in front; *columella without plications;* operculum corneous, sub-spiral, when present.

Genus EULIMA. Risso. (214-220.)

Shell small, white and polished; slender, elongated, with numerous level whorls; spire often curved to one side; *obscurely marked on one side by periodic mouths,* which form prominent ribs internally; *apex acute;* aperture oval, pointed above; outer lip thickened internally; inner lip reflected over the pillar; not umbilicated; operculum horny, sub-spiral. *Dist.*—World-wide—5 to 90 fathoms.

Genus STYLIFER. Brod. (221.)

Syn.—Stylina.

Shell *hyaline*, pellucid, thin, globular or subulate, smooth, polished; whorls numerous; apex very sharp, sometimes bent; *nucleus sinistral*; aperture sub-oval, angulated posteriorly, rounded in front; inner lip smooth, arcuated; outer lip slightly sinuous, thin, simple, no operculum. *Dist.*—Europe, West Indies, Polynesia, Australasia.

(xxi.) Family TURBONILLIDÆ.

(Shell *white*, *slender*, *elongated*, many whorled, *mostly longitudinally ribbed or spirally striate.)*

Genus TURBONILLA. Risso. (222-225.)

Shell slender, elongated, many whorled; whorls plaited; *apex sinistral;* aperture simple, ovate; *peristome incomplete; columella not plaited*; operculum horny, sub-spiral. *Dist.*—World-wide. Range from low water to 90 fathoms.

Genus ACLIS. Lovén. (226.)

Shell *minute, like Turritella;* usually spirally striated; apex sinistral; aperture oval; outer lip prominent; axis slightly rimate, operculate. *Dist.*—Europe, North America, Australasia.

Genus ODOSTOMIA. Fleming. (227-229.)

Syn.—Odontostomia.

Shell subulate or ovate, typically smooth; apex sinistral; aperture *ovate*; peristome *not continuous*; columella *with a single tooth-like fold*; operculum horny, indented on the inner side. *Dist.*—Universal, from low water to 40 fathoms.

Sub-Genus PARTHENIA. Lowe.

Shell thin, turriculate, imperforate, usually milk white, under a very pale, thin, epidermis; whorls ribbed or striate, sometimes cancellate, vanishing at periphery of last whorl. *Dist.*—Japan and Tasmania.

Genus ELUSA. A. Adams. (230.)

Shell *subulate, turreted; whorls longitudinally plicate;* aperture *ovate;* inner lip with a single plait; outer lip often lirate within. *Dist.*—China, Japan, Australasia.

Genus SYRNOLA. A. Adams. (231-232.)

Shell subulate, *straight*, vitreous, *banded*, *polished;* whorls flat; *suture impressed*; aperture *oblong;* inner lip acute, *obliquely plicate in the middle;* outer lip simple, acute.

Genus EULIMELLA. Forbes.

Sub-Genus STYLOPTYGMA. A. Adams. (233.)

Shell elongated, pupiform, turriculate, solid, smooth or slightly ribbed, polished; whorls inflated middle of spire, numerous; apex sinistral; aperture *sub-quadrangular. Dist.*—Europe, Japan, Australasia.

(xxxii.) Family LITTORINIDÆ.

(Shell spiral, *turbinate or globular;* peritreme entire; interior *not nacreous;* operculum corneous, spiral or or pauci-spiral.)

Genus LITTORINA. Ferussac. (234-238.)

Shell turbinated, thick, pointed, few whorled; aperture rounded; outer lip acute; columella rather flattened, imperforate, operculum, pauci-spiral. *Dist.*—Universal on sea shores.

Genus RISELLA. Gray. (239-241.)

Shell depressed, trochiform, with flattened whorls and keeled periphery; not umbilicated; aperture rhomboidal; marked with brown inside the margin; operculum pauci-spiral, distinguished from Trochus, which they resemble, by their non-nacreous interior. *Dist.*—Australasia, sea shore.

Genus FOSSARUS. Philippi. (242-244.)

Shell minute, turbinate, perforate, sculptured; inner lip thin; aperture semi-lunate; operculum not spiral. *Dist.*—Almost world-wide; among weed at low water.

(xxxiii.) Family PLANAXIDÆ.

Genus ALABA. H. and A. Adams. (245-247.)

Shell ovate, conical or elongated, *sub-diaphanous; whorls plicate or varicose;* apex sub-mammillate; aperture ovate, the columella more or less truncate. *Dist.*—Japan, West Indies, Australasia.

Sub-Genus DIALA. A. Adams.

Whorls *not varicose,* sometimes nodulate around the middle; columella *straightish, not truncated;* labrum not thickened. Dist.—Philippines, Japan, Australasia.

(xxxiv.) Family CERITHIIDÆ.

Shell spiral, elongated, many whorled, frequently varicose; *aperture channeled in front,* with a *less distinct* posterior canal; lip generally expanded in the adult; operculum, horny, spiral.

Genus CERITHIUM. Brug. (248-259.)

Shell turreted, many whorled, with indistinct varices; aperture small, *with a tortuous* canal in front; outer lip expanded; inner lip thickened; operculum horny, spiral. *Dist.*—Almost world-wide.

Sub-Genus BITTIUM.

Shell elevated, with numerous *granular* whorls and *irregular* varices; anterior canal short, *not recurved*; inner lip simple; outer lip *not reflected*; usually with an exterior rib; operculum four whorled.

Genus TRIFORIS. Deshayes. (260-261.)

Shell *sinistral*, sculptured, granular; whorls numerous, terminating below in a *small aperture with tubular anterior canal;* opposite this canal is sometimes a second one upon a varix, marking the position of a former aperture; operculum orbicular, few-whorled. *Dist.*—East Indies, Polynesia, Panama, West Indies, Mediterranean, Australasia.

Genus POTAMIDES. Brong. (262.)

Shell often large sized, *turriculated; whorls angulated and coronated;* aperture prolonged in front into a nearly straight canal; outer lip thin, *sinuous; epidermis thick*, olive brown; operculum many whorled. *Dist.*—Tropical and sub-tropical; fresh and brackish streams and swamps.

(xxxv.) Family RISSOELLIDÆ.

Genus TATEA. Tenison-Woods. (263.)

Shell minute, elongate, pyramidal, attenuate, with brownish-black epidermis; spire elevated, acuminate; whorls flattish (8); aperture pyriform; inner lip reflected; operculum horny and thin, with a vertical sub-marginal claw. *Dist.*—Only one representative, *T. Huonensis*, T. Woods. Found under stones at low water in tidal estuaries in Tasmania.

(xxxvi.) Family RISSOIDÆ.

Shell small, spiral, turreted or depressed, often more or less umbilicated; aperture more or less rounded, never truly channeled in front; peritreme continuous.

Sub-Family RISSOININÆ.

Shell small, ovate, or turreted with a thick corneous or calcareous pauci-spiral operculum, with internal process, *articulated (marine).*

Genus RISSOINA. D'Orb. (264-274.)

Shell turreted, whorls numerous, *ribbed or cancellated;* aperture semi-lunar; lip slightly thickened within, somewhat expanded, faintly channeled anteriorly; operculum corneous, thick, semi-lunar, pauci-spiral *with an interior process. Dist.*—World-wide *(marine).*

Sub-Family RISSOINÆ.

Shell small, ovate or elongate; operculum pauci-spiral, *not provided with an internal process (marine).*

Genus RISSOA. Frem. (275-289.)

Shell minute, white or horny, conical, pointed, many whorled; smooth, ribbed or cancellated; aperture rounded; peristome entire or continuous; *outer lip slightly expanded and thickened;* operculum sub-spiral. *Dist.*—Universal *(marine).*

Sub-Genus SETIA. H. and A. Adams.

Shell thin, oval-oblong, or sub-conic; whorls few, ventricose spotted; spire short; apex obtuse; aperture sub-orbicular.

Sub-Genus CERATIA. H. and A. Adams.

Shell *sub-cylindrical, spirally striated,* white, thin, *sub-pellucid;* whorls rounded; summit of spire obtuse; aperture sub-oval; peristome continuous; *the outer lip thin and sharp.*

Sub-Genus CINGULA. Fleming.

Shell thin, *elongated,* smooth or spirally striate, *spotted or banded;* aperture *pyriform or oval;* outer lip *sharp, with an external varix.*

Sub-Genus ALVANIA. Risso.

Shell *oval, turbiniform;* spire *rounded, usually cancellated;* aperture *sub-circular; crenulated within;* outer lip with a marginal exterior varix.

Sub-Family HYDROBIINÆ.

Shell *very small,* or of moderate size, never exceeding two-fifths of an inch in length, globose, ovate or *elongated,* generally *umbilicated or rimate,* and *covered with a periostraca, for the most part of an olive colour;* whorls numerous (4-8) smooth or rarely ribbed or carinated; *never cancellated;* aperture more or less ovate or rounded, rarely sub-acute or effuse anteriorly; *peritreme continuous;* outer lip *usually simple and acute;* operculum pauci-spiral, corneous. *Dist.—Lakes, rivers* and *lagoons,* sea-level to 4,000 altitude; *mostly inhabiting fresh water* but some entering brackish water; herbivorous.

Genus Hydrobia. Hartmann. (290-293.)

Shell minute, ovate or elongated, smooth, *sub-perforate*; spire conic; whorls generally flat; apex acute; aperture ovate; inner lip *not thickened*; operculum corneous; rostrum rather long; tentacles somewhat tapering but blunt at the extremity; foot somewhat pointed behind. *Dist.*—World-wide *fresh and brackish waters.*

Genus Bithynella.? Moquin-Tandon. (294-303.)

Shell minute, elongated-ovate, usually somewhat pupiform, imperforate, or simply rimate; apex obtuse; aperture oval or rounded; peritreme continuous; outer lip sharp or slightly thickened; operculum corneous, nucleus moderately large, not very close to basal margin. Tentacles tapering blunt at the tip; foot rather narrow, rounded behind; very bifid. *Fresh water*, ascending to 4,000 feet altitude in Tasmania. *Dist.*—Europe, America, Australasia?

Genus Potamopyrgus. Stimpson.

Shell ovate-conic, imperforate; apex acute; whorls coronated with spines: aperture ovate; outer lip acute; operculum corneous; rostrum moderate; tentacles very long, slender, tapering, and pointed; eyes on very prominent tubercles; foot rather short, broadest in front, and strongly auriculated. *Dist.*—Fresh water, New Zealand, Tasmania, Cuba.

Genus Potamopyrgus.? Hutton *non* Stimpson. (294-303.)

Shell ovate-conic or oval, imperforate; body whorl more than half the length of shell; aperture ovate, the outer lip acute; peritreme continuous or discontinuous; operculum horny, sub-spiral, without any internal process. *Animal* with the foot rather short, broadest, and slightly expanded in front; tentacles very long, slender, tapering and pointed; eyes on very prominent tubercles. *Dentition*, median tooth trapezoidal; inferior margin more or less trilobate; first lateral broad and excavated in the middle, contracted into a long peduncle, the denticles nearly equal; second lateral pointed at the inner extremity; the shank broad and thickened on its outer margin; third lateral with the inner extremity broad and rounded, constructed at its junction with the very broad shank which is thickened on its outer margin. Number of transverse rows of teeth, 55 to 69. Formula of the denticles $\frac{7 \text{ or } 9}{3 \text{ or } 4-3 \text{ or } 4}$; 9 or 11; 20 to 23; 30 to 40. Hutton's new definition of *Potamopyrgus* would exactly fit the numerous species in Australia, Tasmania, and New Zealand, hitherto variously assigned to *Paludestrina, Amnicola,* and latterly *Bithynella.* It is doubtful, however, whether the greatly modified definition may not have the effect of severing some of the original forms embraced under Stimpson's original definition of Potamopyrgus. A new name, say *Huttonia,* for the Australian, Tasmanian, and New Zealand forms, with the definition given by Professor Hutton, is suggested as the best course to adopt in the classification of Australasian species determined by the dentition characteristics.

Genus BRAZIERIA. Petterd. 1888. (304.)

Shell minute, globosely rounded, *solid, imperforate;* spire small; body whorl large; *aperture very oblique;* outer lip acute; inner lip thickened; operculum horny, sub-spiral. Animal very similar to *Beddomeia Launcestonensis,* Johnston. *Dist.*—Fresh water streams, North-Western Tasmania—River Wye, Surrey Hills, and tributaries of the Arthur River. The shell originally described by Tenison-Woods as *Ampullaria Tasmanica,* and later transferred to genus *Amnicola,* is here provisionally referred to Petterd's new genus, *Brazieria.*

Sub-Genus BEDDOMEIA. Petterd. 1888. (305-310.)

Shell globosely conical, thin, umbilicate or sub-umbilicate; spire short; body whorl inflated; aperture ovate; columella margin more or less thickened; operculum horny, pauci-spiral. Animal with a somewhat broad foot; *tentacles* long, *slender and pointed;* eyes sessile at outer base of same; muzzle broad and projecting. Dentition as in *Potamopyrgus,* Hutton *non* Stimpson, but the trapezoidal median tooth has quite a different arrangement of the inferior basal row, which consists of two ovate elevations on either side of a curved central tooth.

Formula of denticles on median tooth - $\frac{7 \text{ or } 9}{2-1-2.}$

Formerly the writer doubted the wisdom of erecting a new genus for the forms now included as above; but if the difficulty of the alteration of Stimpson's genus Potamopyrgus be surmounted, or if the name *Huttonia,* as suggested, be adopted for Professor Hutton's new definition as applied to Australasian forms, there is little doubt but that the sub-genus erected by Mr. Petterd would be most fitting for Australasian forms of this group.

Sub-Family POMATIOPSINÆ.

(Shell and operculum as in Rissoinæ. Foot with lateral sinus. Amphibious.)

Genus POMATIOPSIS. Tryon. (311-312.)

Shell elongated, frequently decollated, perforate, smooth; *whorls very convex*; aperture round; peristome continuous, slightly expanded or reflected. *Air breathing animal, preferring damp location in the vicinity of streams or lagoons.* *Dist.*—United States, Central America, Australia, Tasmania, Flinders' Island.

(xxxvii.) Family ASSIMINIIDÆ.

Genus ASSIMINEA. Leach. (313.)

Shell small, oval, conical, with moderate spire; aperture rounded, oval, with sharp lip entire; columella lip somewhat thickened. *Dist.*—Europe, Asia, America, Tasmania.

(xxxviii.) Family VALVATIDÆ.

Genus VALVATA. Müeller. (313ᵃ.)

Shell depressed, conical (in the typical group), umbilicated; covered by a thin greenish epidermis; operculum orbicular, corneous, multispiral. Animal with a produced muzzle; tentacles long and slender, eyes at their bases; foot bilobed in front; branchial plume long, pectinated, partly exerted on the right side when the animal is walking; lingual teeth broad, uncini 3 lanceolate; all toothed and denticulated. *Dist.*—Freshwater, mundane.

(xxxix.) Family TRUNCATELLIDÆ.

Genus TRUNCATELLA. Risso. (314-317.)

Shell small, sub-cylindrical or turbinate, with elevated spire; apex obtuse or truncated; whorls striated transversely; aperture oval, entire; peristome continuous; operculum corneous, sub-spiral. Animal with short diverging tentacles; eyes centrally behind; head bilobed; foot short, rounded at each end. *Dist.*—On stones and seaweed *between tide marks.*

(xl.) Family NERITIDÆ.

Genus NERITA. Linn. (318.)

Shell *thick*, smooth or spirally grooved; epidermis horny; outer lip thickened and sometimes *denticulated within*; columella broad and flat, with its inner edge *straight and toothed*; operculum shelly. *Dist.*—Nearly all warm seas, living on rocks and stones at low water.

(xli.) Family LIOTIIDÆ.

(Shell *depressed*, spiral, white ribbed, *sometimes cancellate*, or nodulous; aperture orbicular, rarely pearly within; operculum *corneous inside ;* outside with a calcareous coat of pearl-like shelly particles, spirally arranged.

Genus LIOTIA. Gray. (319-324.)

Shell turbinated or *depressed, varicose*, perforated or umbilicated whorls *ribbed or cancellated;* aperture rounded, *pearly within ;* peristome thick, callously margined. *Dist.*—Tropical and sub-tropical.

Genus CYLOSTREMA. Marryat. (325-333.)

Shell orbicular, depressed, *widely umbilicated, spire short ;* whorls transversely *striated or cancellated ;* aperture round, *not nacreous ;* peristome continuous, simple. *Dist.*—Japan, Philippines, West Indies, Australasia.

(xlii.) Family ROTELLIDÆ.

Genus ROTELLA. Lam. (334.)

Shell depressed, lenticular, the spire depressed, conical; aperture semi-orbicular; outer lip sharp; base with a convex rounded umbilical callus. *Dist.*—India, China, Japan, Philippines, Australasia.

(xliii.) Family PHASIANELLIDÆ.

Genus PHASIANELLA. Lam. (335-339.)

Shell elongated, polished, richly coloured; *whorls convex ;* aperture oval, *not pearly ;* inner *lip callous, outer thin ;* operculum shelly, callous outside, sub-spiral inside. *(Pheasant-shell.)* *Dist.*—Large species, Australasia; small species, India, Philippines; very small species, West Indies, Mediterranean, Great Britain.

(xliv.) Family TURBINIDÆ.

Genus TURBO. Linn. (340-342.)

Shell spiral, turbinated, solid, *nacreous inside ;* whorls convex, smooth, grooved or tuberculated; aperture *large, rounded*, slightly produced in front; operculum *shelly and solid*, callous outside and smooth, or variously grooved and mamillated, internally horny and pauci-spiral. *Dist.*—World-wide; rocks and weeds at low water, along the shore. (*Top-shell.*)

Sub-Genus TURBO. (Restricted.)

Shell smooth, or tuberculate, covered by a smooth epidermis; inner lip flattened, more or less produced in front; *no umbilicus*, operculum spiral on its inner face, convex and smooth or granular (*not ridged*) externally.

Sub-Genus SENECTUS. Humph.

Shell solid, with revolving squamose or spinose ridges covering the whorls; axis usually *narrowly perforated;* aperture usually slightly produced in front, with sometimes a short channel.

Sub-Genus MARMOROSTOMA. Swains.

Shell thick, smooth or tuberculate; aperture rounded in front; columella callus covering the axis, *which is umbilicated*, however; the umbilicus often *at the upper end of a curved channel in the callus;* operculum spiral, with central nucleus, and an indistinct sub-central external rib.

(xlv.) Family TROCHIDÆ.

(Shell usually conical, with *flattened base*, *nacreous inside;* operculum *corneous*, multispiral.)

Genus TROCHUS. Linn. (343-388.)

Shell pyramidal, with nearly a flat base; whorls, numerous, flat, variously striated; aperture oblique, rhombic, pearly inside; columella twisted, slightly truncated; outer lip thin; operculum, horny, multispiral. *Dist.*—World-wide; low water to 15 fathoms, the smaller species to 100 fathoms.

Sub-Genus TROCHUS. (Restricted.)

Umbilical region *excavated but not perforated;* columella *spirally twisted above*, terminating *in a point anteriorly.*

Sub-Genus INFUNDIBULUM. Mont. (CARINIDEA. Swains.)

Shell, conical; whorls *flattened*, *the last angular*, *base concave;* columella *without teeth*, or teeth obsolete.

Sub-Genus MINOLIA. A. Adams.

Shell globosely *conoidal*, widely and *profoundly umbilicated;* whorls rounded, clathrate; suture canaliculate; last whorl, subsolute towards the aperture; umbilicus perspective; aperture circular, pearly within; *peristome*, continuous, thin, acute.

Sub-Genus ASTELE. Swainson. (Tas. Journal, 1855.)

Shell nacreous, *pyramidal* or trochiform; unarmed; body whorl convex; columella, none; *umbilicus large*, closed only by the terminal whorl of the spire; aperture, broader than high, the margin of both lips thin.

Sub-Genus MONILEA. Swainson.

Shell *orbicular, depressed, widely umbilicated;* whorls encircled by grooves, the last rounded; umbilicus *encircled by a striated callus;* columella terminating anteriorly in one or two tubercles.

Sub-Genus GIBBULA.

Shell *conoidal, umbilicated; umbilicus cylindrical or infundibuliform;* whorls frequently tuberculated above, and with channeled suture; columella *sometimes* terminating in a tubercular tooth.

Sub-Class ZIZYPHINUS. Gray. (CALLIOSTOMA.) Swains.

Shell trochiform, conical, *not umbilicated;* last whorl *angulated* and usually *ribbed at the periphery;* aperture, *quadrangular;* columella simple, oblique, often ending in a tooth in front.

Sub-Genus THALOTIA. Gray.

Shell ovate-turriculated, rather thick, *not umbilicated;* whorls *flattened,* with revolving *ribs, which are sometimes granular;* aperture, sub-rotund; columella *tuberculate, truncate in front;* outer lip *rather thick, crenulated within.*

Sub-Genus ELENCHUS. Humphrey.

Shell elevated, conoidal, *spire sharp;* whorls *rather flat, smooth, polished,* usually *with distant revolving incised lines;* aperture *sub-oval;* columella with *a tooth-like projection in the middle;* outer lip thickened within. Brilliantly coloured shells, but very pearly within (used as ornamental necklaces by the Tasmanian Aborigines).

Sub-Genus CANTHARIDUS. Montfort.

Shell ovate, thin, outer lip acute; the columella wants the conspicuous tooth seen in *Elenchus;* the whorls are *encircled by striæ and not polished;* interior highly iridescent.

Sub-Genus BANKIVIA. Beck.

Shell *subulate,* with sharp spire, polished, bright coloured; whorls smooth, flattened, *without epidermis;* aperture sub-ovate, rather large, *not nacreous within;* columella twisted, truncated in front; outer lip simple, sharp.

Sub-Genus TROCHOCOCHLEA. Klein.

Shell elevated, turbiniform; whorls bluntly angled at the periphery, or with revolving carinæ; outer lip thin, smooth within; inner lip *spreading, twisted, dentate below, no umbilicus.*

Sub-Genus EUCHELUS. Phil.

Shell *conoidal, turbinate umbilicated*; whorls rounded, with *granulated* revolving ribs; columella lamellarly produced into a central tooth; outer lip thickened and *crenulate within*; opercular whorls rather few, rapidly increasing.

Sub-Genus CLANCULUS. Montfort.

Shell conoidal or turbinated, *not umbilicated*; whorls mostly *granulous*; aperture contracted; columella spirally twisted, forming a *false umbilicus, plicated throughout* and terminating in a *multi-dentate varix*; outer lip *dentate within*, with sometimes a larger superior tooth.

Sub-Genus DILOMA. Philippi.

Shell *conoidal, smooth, not umbilicated*; whorls rather few, *convex*; aperture sub-rotund; columella lip *excavated in the middle and expanded over the umbilicus region*, produced laterally to join the outer lip; outer lip thin, unarmed.

Genus MARGARITA. Leach. (—)

Shell *thin, globular, conical, umbilicated*; whorls rounded, smooth; aperture rounded, pearly; lip sharp, smooth. *Dist.*—Japan, California, Australasia.

(xlvi.) Family STOMATELLIDÆ.

Genus STOMATELLA. Lam. (389.)

Shell *ear-shaped*, regular; spire small; aperture oblong, very large and oblique, *nacreous*; lip thin, even edged; operculum circular, *horny*, multispiral. *Dist.*—On reefs and under stones at low water.

Genus STOMATIA. Helbing. (390.)

Shell like *Haliotis, but without perforations*, their place being occupied by a *simple furrow*; surface rugose, smooth or spirally ridged; spire small, prominent; aperture *large, oblong;* outer magin irregular. *Dist.*—Java, Philippines, Torres Straits, Pacific, Australasia.

Sub-Genus GENA. Gray.

Shell sub-spiral, *oblong, auriform, depressed*, smooth or striated; *spire flattened, nearly obsolete*; aperture very large; no operculum.

(xlvii.) Family PLEUROTOMARIIDÆ.

Shell more or less conically elevated, turreted or trochiform, *with a marginal slit* in the upper part of the outer lip, or a row of perforations in the upper part of the whorl; aperture often pearly within.

Genus SCHISMOPE. Jeffreys. (391.)

Shell minute, thin, translucent, *not pearly*; spire laterally compressed, as in Stomatia; *slit* of the young shell is *converted into a foramen* in the adult; it does not commence until the animal is half grown. *Dist.*—Mediterranean, Japan, Tasmania.

(xlviii.) Family HALIOTIDÆ.

Genus HALIOTIS. Linn. (392-395.)

Shell *ear-shaped*, large, with a small flat spire; aperture very wide, *iridescent*; exterior striated, dull; outer angle *perforated by a series of holes*, those of the spire progressively closed. *Dist.*—Almost world-wide.

(xlix.) Family FISSURELLIDÆ.

Shell conical, *limpet-shaped*; apex recurved; nucleus spiral, *often disappearing* in the course of growth; anterior margin *notched* or apex *perforated*; muscular impression horse-shoe shaped, open in front.

Genus FISSURELLA. Lam. (396-401.)

Shell oval, *conical, depressed*, with the apex in front of the centre, *and perforated*; surface radiated or cancellated; muscular impression with the points incurved. *Dist.*—Universal, but mostly in warm seas.

Sub-Genus MACROSCHISMA. Swainson.

Shell *square, oval, roughly rayed*, truncate at the end; perforation *very large, sub-triangular*, elongated.

Genus EMARGINULA. Lam. (402-405.)

Shell oval, conical, *elevated, with the apex recurved*; surface *cancellated*; *anterior margin notched*; muscular impression with recurved points. *Dist.*—Almost world-wide, range low-water to 90 fathoms.

Genus PARMOPHORUS. Blainv. (406-408.)

Shell *lengthened oblong depressed*; apex posterior; front margin incurved; muscular impression horse-shoe shaped, elongated; shell smooth, white. *Dist.*—East Indies, Philippines, Australasia.

(l.) Family PATELLIDÆ.

Shell *wholly external*, disc shaped, with apex anteriorly directed. (*Limpets.*)

Genus ACMÆA. Esch. (409-417.)

Shell solid, limpet form; *apex erect*, or anteriorly inclined. *Dist.*—Mostly West Coast of North America, Europe, Australasia.

Genus PATELLA. (418-424.)

Shell conical, *more or less depressed*, oval at the base; apex subcentral or anterior, from which usually radiate ribs, which are are frequently nodose; mostly crenulated on the inner margin. *Dist.*—World-wide. (Common Limpet.)

(li.) Family CHITONIDÆ.

Shell composed of *eight separate transverse imbricating plates*, lodged in a coriaceous mantle, which forms an expanded margin around them.

Genus CHITON. Linn. (425-433.)

Same general description as given for the family.

Sub-Genus CHITON. Lam.

Girdle covered with distinct scales; anterior and posterior valve with many slits, middle valve with one.

Sub-Genus LOPHYRUS. Poli. (RADSIA. Gray.)

Teeth in *middle valve two or more*; differs also from Chiton in having side slits.

Sub-Genus LEPIDOPLEURUS. Risso. (Isnochiton.)

Scales transverse, flattened, somewhat imbricated, generally striated.

Sub-Genus PLAXIPHORA. Gray. (EUPLACIFORA. Gray.)

Mantle with a double series of pores, beset with bifurcate bristles, one row at the insertion of the valves, the other at the external margin; shell with the valves broad, transverse, external.

Sub-Genus ACANTHOCITES. Risso.

Mantle densely spinulose, surrounded with a series of setigerous pores; shell with the valves deeply immersed, sub-equal externally, the exposed part moderate; cordate as broad as long; plate of insertion of the anterior valve six lobed, that of the middle bilobed, that of the posterior five lobed,

Genus CHITONELLUS. Blainville. (434-435.)

Tail plate funnel shaped; laminæ thrown forward; insertion plates very sagittate; slits in anterior valve 5, in middle 0-1, in posterior none; teeth very short, except of sutures; eaves distinct; sinus very deep and narrow; girdle crowded with bristles, no tufts; gills posterior.

Sub-Genus CRYPTOPLAX. Gray.

Middle valve without ribs; girdle with crowded bristles, tufted.

(lii.) Family PHILINIDÆ.

Genus PHILINE. Ascanias. (436.)

Shell *bulliform*, *not forming a single whorl*, internal, white. translucent, oval, slightly convoluted; spire rudimentary *Dist.*—West Indies, Boreal Atlantic, Mediterranean, East Indies, Australasia.

(liii.) Family TORNATELLIDÆ.

Shell *spiral*, *ovate*, *convolute* or involute, spire more or less elevated; surface mostly *spirally punctated*; aperture usually high and narrow, truncate or roundish in front; columella solid.

Genus TORNATINA. D'Orb. (437.)

Shell oval, elongated, conical or fusiform, with revolving punctated striæ; aperture long and narrow, widened in front, entire; lip sharp; columella thickened, but without plications. *Dist.*—Almost world-wide.

Genus RINGICULA. Desh. (438.)

Shell *minute*, ventricose, with small spire; aperture *notched*; columella callous, *deeply plaited*; outer lip *thickened and reflected*. *Dist.*—In all warm seas.

(liv.) Family CYLICHNIDÆ.

Shell external, spiral, *more or less cylindrical*; nearly white; no operculum.

Genus CYLICHNA. Lorén. (439-440.)

Shell strong, *cylindrical*, smooth, or punctate-striate; spire minute or truncated; aperture narrow, rounded in front; columella callous, with one plait. *Dist.*—Chiefly deep water shells, Greenland, Britain, Red Sea, Australasia.

(lv.) Family BULLIDÆ.

Shell spiral, *ventricose*, *rather thick*, *maculated* and *banded* in the typical genus, white in others; spire *involute*, external, but usually partly covered by the lateral lobes of the foot.

Genus BULLA. Linn. (441.)

Shell oval, globular, smooth, spotted, marbled or zoned; spire concave; aperture as long as the shell; inner margin without columella; outer lip trenchant. *Dist.*—Universal.

Genus HAMINEA. Linn. (442)

Shell oval, globular, spiral, ventricose, *corneous*, thin, covered by a slight *smooth epidermis*; spire involute; lacks the colours of Bulla.

(lvi.) Family LOPHOCERIDÆ.

Genus AKERA. Muller. (443.)

Shell like Bulla, thin, flexible, globosely cylindrical; spire truncated; whorls channeled; aperture long, expanded and deeply sinuated in front; outer margin disunited at the suture; columella open, exposing the whorls. *Dist.*—Greenland, Great Britain, Mediterranean, East Indies, Australasia.

(lvii.) Family APLYSIIDÆ.

Shell wanting or rudimentary, and covered by the mantle; *oblong, trigonal or slightly convoluted*; large, slug-like animals.

Genus APLYSIA. Gmelin. (444-445.)

Shell oblong, convex, *flexible and translucent*, with a posterior slightly incurved apex. (Sea-hare.) *Dist.*—West Indies, Norway, Britain, Mediterranean, Mauritius, China, Australasia.

(lviii.) Family VITRINIDÆ. (Land Shells.)

Shell usually thin, corneous, transparent, spiral, of *few rapidly enlarging whorls.*

Genus VITRINA. Drap. (446-448.)

Shell imperforate, very thin, depressed; spire short, last whorl large; aperture large, lunate or rounded; columella margin slightly inflected; peristome often membranous. *Dist.*—Universal, mostly inhabit cold or temperate countries or mountain regions of warm countries.

(lix.) Family HELICIDÆ. (Land Shells.)

(Shell spiral, usually thicker than in the Zonitidæ, and mostly with reflected lip, the aperture edentulous or contracted by teeth.)

Genus HELIX. (449-518.)

Shell of variable form, smooth, rugose, striate, ribbed or tuberculate, sometimes pilose; orbicular convex, planorbid, trochiform subturriculated, or short bulimiform (monstrosities sinistral, or with the whorls more or less uncoiled); aperture oblique, oval or semi-lunar, with or without interior teeth on the margin or parietal wall; lip simple or thickened internally or reflected, umbilicus covered, widely open. *Dist.*—Universal.

Genus **Bulimus**. (519-520.) Land Shells.

Shell *oval-oblong* or *turriculated,* solid, sub-perforate or imperforate; whorls few, the last ventricose and large; aperture longitudinal; columella widened, rarely plicate; peristome thickened, reflected; the lip usually joined by a callus. *Dist.*—Mostly South American.

(lx.) Family Pupidæ. (Land Shells.)

Shell generally *minute,* multispiral, cylindrical, with obtuse summit (pupiform); *aperture small,* usually contracted by internal teeth or lamellæ.

Genus **Pupa**. (521.)

Shell usually *very small, cylindrical or oval*-oblong; umbilicus slight or a mere slit; plicate, striate or costellate brown or horn-colour; columella *plicate or sub-dentate; lip reflected,* usually dentate or plicate within, the extremities usually joined by a raised callus. *Dist.*—Universal, boreal and tropical.

(lxi.) Family Limacidæ. (Terrestrial Land Slugs.)

Shell *rudimentary, a calcareous plate, not spiral,* concealed under the mantle, and covering the respiratory cavity.

Genus **Limax**. (522.)

Shell-plate *testaceous thin, flat,* longer than wide, with concentric striæ of increase, internal. *Dist.*—Universally distributed.

(lxii.) Family Arionidæ.

(*Animal naked,* with or without mucous pore; mantle concealing a shell-plate, or a few calcareous grains which represent it; jaw strongly ribbed; central tooth tricuspidate, the median cusp long and narrow; laterals and marginals bicuspidate.)

Genus **Cystopelta**. (523.)

Body attached for half its length to the back of the foot; mantle very large, enveloping the whole animal in repose, but from beneath which the head and the tip of the tail alone are visible from above when the animal is crawling; tentacles four; tail with a mucous spore at the tip; mandible like that of Arion; lingual teeth resembling those of Testacella. No shell. *Dist.*—Tate. Tasmania.

(lxiii.) Family SUCCINEIDÆ.

Genus SUCCINEA. (524-525.)

Shell oval, very fragile and transparent; spire short; the whorls few, and very rapidly enlarging; aperture oval; outer lip thin, not reflected, united below by a very broad curve with the thin, smooth columella. *Dist.*—World-wide; sub-aquatic, living in damp places, near the margin of streams.

(lxiv.) Family AURICULIDÆ.

(Shell oblong-oval, covered by a thin epidermis; spire short, conoidal, very rarely sub-elongated; last whorl large; rounded at the base; aperture longitudinal, narrow, ear-shaped; inner wall of the aperture with two or three plications, peristome thickened internally, without teeth.)

Genus CASSIDULA. (526-529.)

Shell sub-perforated, cassidiform, solid; spire short, conoidal; last whorl very large, attenuated to the base, where it is usually carinated or angulated around the axis; aperture narrow, sinuous; inner lip dentately plicate; columella plication strong; outer lip thickened within by a strong callosity with toothed edge. *Dist.*—Ceylon, East Indies, Philippines, Australasia, Polynesia.

Genus ALEXIA. (527.)

Shell oblong-oval, thin, spire acuminate; last whorl large, rounded at base; columella with an oblique plait; aperture contracted by teeth, and sometimes by a callosity of the outer lip. *Dist.*—United States, West Indies, Maderia, Europe.

Genus MARINULA. (528.)

Shell oval-oblong, imperforate, solid, smooth; spire short, sharp; aperture oval; inner lip rather thick, excavated with three plications, the posterior largest; outer lip simple, sharp. *Dist*—Australia, Mediterranean, W. Coast of America.

Genus OPHICARDELUS. (529.)

Shell oval-oblong, umbilicated, smooth; spire elevated-conic; aperture oval, elongated, angulated above; inner lip reflected, with two spiral plications, one of which surrounds the umbilicus; outer lip thin, simple. *Dist.*—Australia, Polynesia.

(lxv.) Family LIMNÆIDÆ.

Shell thin, horn-coloured, mostly spiral, sometimes patelliform, capable of containing the entire animal, contracted; aperture simple, rounded; lip sharp.

Genus LIMNÆA. (530-533.)

Shell normally dextral, oval-oblong, thin, corneous, translucid; spire sharp, more or less acuminated; last whorl ventricose; aperture oval, ample, rounded in front; columella lip with an oblique plait entering above. *Dist.*—Europe, Asia, America, North of the Equator, Polynesia.

Genus AMPHIPEPLEA. (534-535.)

Shell globular, ventricose, thin, transparent; spire very short, depressed; aperture very large; columella without fold; outer lip sharp. *Dist.*—Europe, East Indies, Australia, Philippines.

Genus PHYSA. (536-547.)

Shell ovate, sinistrally spiral, thin, polished; aperture rounded in front. *Dist.*—North America, Europe, East Indies.

Genus PLANORBIS. (548-551.)

Shell discoidal, biconcave, the whorls visible on both sides; aperture small, rounded, margin usually simple, sometimes expanded. *Dist.*—World-wide.

Genus ANCYLUS. (552-554.)

Shell conical, limpet-shaped, thin; apex posterior turned to the left; aperture with entire basal margin; interior with a sub-spiral muscular scar. *Dist.*—North and South America, Europe, Australia.

Genus GUNDLACHIA. (555-556.)

Shell very small, thin, obliquely conic, apex inclined posteriorly and to the right; base two-thirds closed by a flat, straight-edged shelf, leaving a semicircular aperture. *Dist.*—United States, Cuba, Tasmania.

(lxvi.) Family AMPHIBOLIDÆ.

Genus AMPHIBOLA. (557-559.)

Shell sub-globose, rather thick, rugose, umbilicated; spire short, whorls shouldered above, umbilicated; aperture sub-oval; columella lip callous; columella flattened and reflected; outer lip sinuous posteriorly; operculum corneous, sub-spiral. *Dist.*—New Zealand.

(lxvii.) Family SIPHONARIIDÆ.

Genus SIPHONARIA. (560-562.)

Shell solid, porcellanous; apex central or sub-central; provided with more or less elevated radiating ribs or ridges, which by their projection render the margin irregular. *Dist.*—Cape, India, Philippines, Australia, New Zealand, Pacific, Galapagos, Peru, Cape Horn, West Indies, West Coast of North America.

CLASS SCAPHOPODA.

(lxviii.) Family DENTALIIDÆ.

Genus DENTALIUM. (563-564.)

Shell *tube-like*, gradually tapering posteriorly, longtitudinally ribbed, margin of the aperture sharpened, posterior end with an internal, slightly projecting tube, which is provided with a dorso-ventrally elongated opening; the outer layer having a very slight emargination dorsally and ventrally. *Dist.*—Universal.

CLASS PELECYPODA.

(Lamellibranchiata. Conchifera.)

(lxix.) Family GASTROCHÆNIDÆ.

Shell *equivalve*, gaping; valves *thin*, edentulous, united by a thin external ligament, sometimes *cemented to a shelly tube* when adult; adductor impressions 2, pallial line *sinuated*.

Genus ASPERGILLUM. (565.)

Shell small, equilateral, *cemented to the lower* end of a *shelly tube, the umbones alone visible* externally; tube elongated, closed below by a perforated disc, with a minute central fissure; siphonal end plain, or ornamented with ruffles. *Dist.*—Red Sea, Java, Australia, New Zealand; in sand.

Genus GASTROCHÆNA. (566.)

Shell *elongated*, *narrow*, contained within *a shelly tube*; posterior adductor nearly central, with a pedal star in front; siphonal inflection angular, with its apex joining the pallial line; tube round, straight, tapering upwards, transversely striated, closed at the lower end when complete, and furnished with a perforated diaphragm behind the valves. *Dist.*—Madagascar, India, Philippines, Australia; burrowing in sand or mud.

(lxx.) Family TEREDIDÆ.

Genus TEREDO. (567.)

Shell *globular*, open in front and behind, lodged at the inner extremity of *a burrow partly or entirely lined with shell*; valves *three lobed*, concentrically striated, and with one transverse furrow; hinge margins reflected in front, marked by the anterior muscular impressions; umbonal cavity with a long, curved, muscular process. *Dist.*—Norway, Britain, Black Sea, Tropics, Australasia. 119 fathoms.

(lxxi.) Family PHOLADIDÆ.

Genus BARNEA. (568.)

Shell *oval*, oblong, anteriorly gaping; with *a single* lanceolate *dorsal accessory valve*; umbonal process reflected, closely applied. *Dist.*—Australia, Burmah, Red Sea, Europe, Patagonia, Philippines.

(lxxii.) Family SOLENIDÆ.

Genus SOLEN. (569.)

Shell *very long*, *sub-cylindrical*, *straight*, margins parallel, ends gaping; beaks terminal, or sub-central; hinge teeth, one in each valve; ligament long, external; anterior muscular impression elongated; posterior oblong; pallial line extending beyond the adductors; sinus short and square. *Dist.*—World-wide, except Arctic Seas; 100 fathoms.

(lxxiii.) Family SAXICAVIDÆ.

Shell equivalve, *thick*, *gaping at the extremities*; hinge with a single cardinal tooth; ligament external, prominent, solid, inserted in a nymphal callosity; pallial impression *irregular*, *sinuous*.

Genus SAXICAVA. (570.)

Shell when young symmetrical, with two minute teeth in each valve; adult rugose, toothless; oblong, equivalve gaping; ligament external; *pallial line sinuated*, *not continuous*. *Dist.*—Universal.

Genus PANOPÆA. (571.)

Shell equivalve, thick, oblong, gaping at each end, ligament external *on prominent ridges*; one prominent tooth in each valve; *pallial sinus deep*. *Dist.*—Northern Seas, Mediterranean, Cape, Australia, New Zealand, Patagonia; low water—90 fathoms.

(lxxiv.) Family CORBULIDÆ.

Shell *small*, inequivalve, thick, *gaping in front*; hinge consisting of a single recurved tooth in one valve, received into a fosset or notch in the other.

Genus CORBULA. (572-573.)

Shell thick, *inequivalve*, *gibbose*, closed, produced posteriorly; right valve with a prominent tooth in front of the cartilage pit; left valve smaller, with a projecting cartilage process; pallial sinus slight; pedal scars distinct from the adductor impressions. *Dist.*—United States, Norway, Britain, Mediterranean.

Genus NEÆRA. (574.)

Shell *globular*, *attenuated*, and gaping behind; right valve a little the smallest; umbones strengthened internally by a rib on the posterior side; cartilage process spatulate in each valve (furnished with a movable ossicle—Deshayes), with an obsolete tooth in front, and a posterior lateral tooth; pallial sinus very shallow. *Dist.*—Norway, Britain, Mediterranean, Canaries, Madeira, China, Moluccas, New Guinea, Chili; from 12-200 fathoms.

(lxxv.) Family ANATINIDÆ.

Shell often inequivalve, *thin*, *interior nacreous*; surface granular; ligament external, thin; cartilage internal, placed in corresponding pits and usually furnished with a free ossicle; muscular impressions faint, the anterior elongated; pallial line usually sinuated.

Genus ANATINA. (575-578.)

Shell *oblong*, *ventricose*, sub-equivalve, *thin and translucent*, posterior side attenuated and gaping; umbones fissured, directed backwards, supported internally by an oblique plate; hinge with a spoon-shaped cartilage process in each valve, furnished in front with a transverse ossicle; pallial sinus wide and shallow. *Dist.*—India, Philippines, New Zealand, Japan, United States.

Genus MYODORA. (579-583.)

Shell *trigonal*, *rounded in front*, *attenuated and truncated behind*; right valve convex, left flat; interior pearly; cartilage narrow, triangular, between two tooth-like ridges in the left valve, with a free sickle-shaped ossicle; pallial line sinuated; structure like Anatina; outer cells large, rather prismatic. *Dist.*—New Zealand, New South Wales, Philippines.

Genus MYOCHAMA. (584-585.)

Shell inequivalve, *attached by the dextral valve, and modified* by the form of the surface of attachment; posterior side *attenuated*; *left valve gibbose*; cartilage internal, between two tooth-like projections in each valve, and furnished with a movable ossicle; anterior muscular impression curved, posterior rounded, pallial sinus small. *Dist.*—Australasia; attached to Crassatella and Trigonia in 8 fathoms water; the fry, (as indicated by the umbones) is free, regular and Myodora-shaped.

(lxxvi.) Family MACTRIDÆ.

Shell *equivalve*, *trigonal*, close or slightly gaping; ligament (cartilage) *internal*, sometimes external, contained in a *deep triangular pit; epidermis thick*; hinge with two diverging cardinal teeth, and usually with anterior and posterior laterals; pallial sinus short, rounded.

Genus MACTRA. (586-588.)

Shell nearly *equilateral*; anterior hinge-tooth Λ shaped, with sometimes a small laminar tooth close to it; lateral tooth doubled in the right valve. *Dist.*—All seas, especially within the tropics; 35 fathoms.

Genus LUTRARIA. (589.)

Shell *oblong*, *gaping at both ends*; cartilage plate prominent, with 1 or 2 small teeth in front of it in each valve; pallial sinus deep, horizontal. *Dist.*—United States, Brazil, Britain, Mediterranean, Senegal, Cape, India, New Zealand, Sitka.

(lxxvii.) Family PAPHIIDÆ.

Genus PAHIA. (590-595.)

Shell *trigonal*, *thick*, *compressed*, closed; ligament *internal*, *in a deep*, *central pit*; a minute interior hinge-tooth, and 1—1 lateral teeth in each valve; muscular scars deep; pallial sinus small. *Dist.*—West Indies, Mediterranean, Crimea, India, New Zealand, Tasmania, Chili; sands at low-water.

Sub-Genus MESODESMA. Desh.

Shell *oval*, *sub-equilateral*; lateral teeth short, smooth, subequal; siphonal inflection distinct.

Sub-Genus DONACILLA. Lam.

Shell *elongate*, *cuneiform*, slightly *truncate posteriorly*; anterior lateral teeth *elongated*; posterior short; siphonal sinus distinct.

Sub-Genus ANAPA. Gray.

Shell *sub-trigonal, ventricose,* truncate posteriorly; lateral teeth sub-equal, compressed, smooth; siphonal inflection *obsolete.*

(lxxviii.) Family SEMELIDÆ.

Genus SEMELE. (596-598.)

Shell *rounded, sub-equilateral, beaks turned forward*; posterior side *slightly folded*; hinge-teeth 2·2, laterals elongated, distinct in the right valve; external ligament short, cartilage internal, long, oblique; pallial sinus *deep, rounded. Dist.*—West Indies, Brazil, India, China, Australasia, Peru.

(lxxix.) Family TELLINIDÆ.

Shell *free, compressed,* usually closed and equivalve; cardinal teeth, 2 at most, laterals 1—1, sometimes obsolete; muscular impressions rounded, polished; pallial sinus very large; ligament on shortest side of the shell; external structure obscurely prismatic-cellular; prisms fusiform, nearly parallel with surface, radiating from the hinge in the outer layer, transverse in the inner.

Genus TELLINA. (599-606.)

Shell slightly *inequivalve, compressed,* rounded in front, angular and slightly folded posteriorly, umbones sub-central; teeth 2·2, laterals 1—1, most distinct in the right valve; pallial sinus very *wide and deep;* ligament external, prominent. *Dist.*—In all seas, especially the Indian Ocean. Most abundant and highly coloured in the Tropics. Low water—coral zone, fifty fathoms. Wellington Channel, Kara Sea, Behring's Straits, Baltic, Black Sea.

Genus GARI. (607-609.)

Shell transverse, *oval-oblong, flat,* equivalve, sub-equilateral, *concentrically plicate,* a little gaping on each side and covered by a *thin epidermis;* hinge narrow, with two small cardinal teeth, sometimes bifid, in each valve; beaks small; ligament long and prominent; margins simple; muscular impressions rather large, equally distant from the hinge, the anterior oblong, the posterior rounded; pallial impression distant from the margin, with a *narrow, profound* sinus. *Dist.*—Norway, Britain, India, New Zealand, Pacific; littoral—coralline zone, 100 fathoms. *G. Gari* is eaten in India.

Genus HIATULA. (610-611.)

Valves *oval-oblong*, *compressed*, ventral margin usually *incurved* posteriorly, where the valves are attenuated; broadly rounded anteriorly; beaks sub-median, not prominent, violaceous, under an olive epidermis; ligament thick, swollen; one or two very small cardinal teeth in each valve; muscular impressions rounded, distant; pallial impression *very sinuous*. *Dist.*—W. Indies, Red Sea, India, Madagascar, Japan, Australia, Tasmania, Peru.

(lxxx.) Family VENERIDÆ.

(Shell *regular*, *closed*, *sub-orbicular or oblong;* ligament external; hinge with usually three diverging teeth in each valve; muscular impression oval, polished; *pallial line sinuated.*)

Genus VENUS. (612-623.)

Shell thick, *ovate*, smooth, sulcated, or cancellated; margins minutely crenulated; cardinal teeth 3·3; pallial sinus *small*, *angular;* ligament prominent; lunule distinct. *Dist.*—World-wide. Low water, 140 fathoms. *V. Astartoides*, Behring's Sea. *V. Verrucosa*, Britain, Mediterranean, Senegal, Cape, Red Sea, Australia ?

Sub-Genus CHIONE. Megerle. (MURCIA, Romer. OMPHALOCLATHRUM. Klein.)

Shell *oval*, *triangular* or *sub-cordiform; margins finely crenulated;* hinge narrow, solid, with *three teeth in the right* valve, *two in the left*, the anterior tooth longest; ligament narrow; pallial sinus *shallow*. Mantle-margins folded and dentate; siphons short, unequal, the branchial doubly cirrated, the anal ciliated.

Genus CYTHEREA. (624-631.)

Shell like Venus; oval-triangular, smooth; margins simple; hinge with *three cardinal teeth* and an *anterior tooth beneath the lunule; pallial sinus moderate*, *angular*. *Dist.*—Same as Venus. Recent. 150 sp.

Sub-Genus CALLISTA.

Shell oval, *transverse*, *inequilateral ;* pallial sinus sub-oval, profound. Mantle-margins folded and cirrous above the siphons; siphons united, cirrated at their extremities.

Sub-Genus GOULDIA.

Shell *sub-trigonal*, *oval*, *shining*, *inflated.*

Genus DOSINIA. (632-636.)

Shell *orbicular, compressed, concentrically striated*, pale, ligament sunk; lunule deep; hinge like Cytherea, margins even; pallial sinus *deep, angular*, ascending. *Dist.*—Boreal, Tropical Seas. Low water, 80 fathoms.

Sub-Genus GOULDIA.

Shell sub-trigonal, oval, smooth, shining, inflated.

Genus TAPES. (637.)

Shell *oblong*, umbones anterior, margins smooth; teeth, three in each valve, *more or less bifid;* pallial sinus *deep, rounded. Dist.*—Norway, Britain, Black Sea, Senegal, Brazil, India, China, New Zealand. Low water, 100 fathoms.

(lxxxi.) Family CYRENIDÆ.

Shell *sub-orbicular*, closed, ligament external; *epidermis thick, horny;* umbones of aged shells eroded; hinge with two or three cardinals and lateral teeth; pallial line with a *small inflection.*

Genus CORBICULA. (638.)

Shell sub-cordiform, solid, close, concentrically striated or rigid, covered by a smooth, greenish epidermis; three cardinal teeth in each valve, the right anterior and left posterior rather small; lateral teeth elongated, compressed, striated; ligament prominent, thick; pallial impression with a slight or well-marked sinus. *Dist.*—India, East Indies, Philippines, S. America.

Genus PISIDIUM. (639-640.)

Shell *sub-oval, trigonal*, inequilateral, covered by a greenish *epidermis;* cardinal teeth very small, elongated, one sometimes bifurcated in the right valve, two diverging in the left valve; lateral teeth longitudinal, compressed, lamelliform, double in the right valve. *Dist.*—Universal. *Fresh water lakes and rivers*, Tasmania.

Genus SPHÆRIUM. (41.)

Syn. Cyclas.

Shell thin, *oval or sub-orbicular*, inflated, covered by a *greenish epidermis;* cardinal teeth very small or rudimentary, one more or less bifurcated, one in the right and two oblique ones in the left valve; lateral teeth compressed, lamelliform, the anterior shortest; ligament short; margins plain, muscular impressions scarcely apparent, sub-marginal; pallial impression simple. *Dist.*—Universal.

(lxxxii.) Family PETRICOLIDÆ.

Genus RUPELLARIA. (642-647.)

Shell *elongated*, moderately tumid, *surface rugosely striated* and *ribbed*, distinctly *gaping posteriorly ;* hinge in the right valve with two cardinal teeth, and a third very small, but usually obsolete, anterior; the middle one is prominent, curved as in Petricola; the posterior is longitudinally lamellar, low and bifurcate; in the left valve are three distant and very unequal cardinal teeth; the middle one is similarly projecting as the corresponding tooth in the other valve. *Rup. lamellifera*, Conrad; may be considered as a type of a group. *Dist.*—Europe, Pacific, etc.

(lxxxiii.) Family CARDIIDÆ.

Genus CARDIUM. (648-651.)

Shell *ventricose*, close or gaping posteriorly; umbones *prominent*, sub-central; *radiately ribbed ;* margins *crenulated ;* pallial line more or less sinuated. *Dist.*—World-wide; from sea shore to 140 fathoms. Gregarious on sands and sandy mud.

(lxxxiv.) Family CHAMIDÆ.

Genus CHAMA. (652.)

Shell attached *usually by the left umbo ; valve foliaceous*, the *upper smallest ;* hinge tooth of free valve thick, curved, received between two teeth in the other; adductor impressions large, oblong, the anterior encroaching on the hinge-tooth. *Dist.*—Tropical seas, especially amongst coal reefs: fifty fathoms. West Indies, Canaries, Mediterranean, India, China, Australasia.

(lxxxv.) Family LUCINIDÆ.

Shell *orbicular*, free, closed; hinge-teeth 1 or 2; laterals 1—1; or obsolete; interior dull, *obliquely furrowed ;* pallial line simple; muscular impressions two, *elongated*, *rugose*, ligament external or sub-internal.

Genus LUCINA. Brug. (653-655.)

Shell *orbicular*, *white*, sometimes divaricately striate; umbones depressed; lunule distinct; margins smooth or minutely crenulated; ligament oblique, *semi-internal ;* hinge-teeth 2—2, latterals 1—1 and 2—2 or obsolete; muscular impressions rugose, anterior elongated within the pallial line, posterior oblong; umbonal area with an oblique furrow. *Dist.*—Universal.

Sub-Genus. CYCLAS. Klein.

Valves divaricately striate.

Genus LORIPES. Poli. (656.)

Shell almost equilateral, *cancellated or sculptured by flexuous striæ;* lunule short, cartilage *quite internal;* teeth one cardinal in the right and two in the left valve; laterals remote, and sometimes indistinct. *Dist.*—Atlantic, Mediterranean, W. Indies, Australasia.

(lxxxvi.) Family UNGULINIDÆ.

Genus MYSIA. (657.)

Shell *sub-orbicular smooth;* ligament *double*, rather long, sub-marginal; hinge-teeth 2·2, of which the anterior in the left valve, and posterior in the right are bifid; muscular impressions polished, anterior elongated. *Dist.*—West Indies, Rio, Britain, Mediterranean, Red Sea, West Africa, India, Corea, Australia, California.

(lxxxvii.) Family ERYCINIDÆ.

Shell *very small, thin, fragile, usually transparent*, and sometimes gaping, rounded or transverse, laterally depressed; hinge narrow, with one or two cardinal teeth, the lateral more or less elongated, compressed sometimes wanting; muscular impressions small, not well-marked; pallial line *simple.*

Genus LASÆA. (658-659.)

Shell minute and *roundish, oval;* beak straight; cartilage long, placed at the *shorter end of the shell*, contrary to that in *Kellia;* left valve with a minute thorn-like cardinal tooth; and in each valve two remarkably strong lateral teeth. *Dist.*—Universal.

Genus KELLIA. (660-661.)

Shell small, thin, sub-orbicular, closed, *beaks small;* margins smooth; ligament internal, interrupting the margin, or on the thickened margins; cardinal teeth 1 or 2, laterals 1—1 in each valve. *Dist.*—Norway, New Zealand, California.

(lxxxviii.) Family CRASSATELLIDÆ.

Genus CRASSATELLA. (662-664.)

Shell *solid, ventricose*, attenuated behind, smooth or concentrically furrowed; lunule distinct; *ligament internal;*

margin smooth or denticulated; pallial line simple; hinge-teeth 1·2, striated in front of cartilage-pit; lateral teeth 0—1, 1—0; adductor impressions deep, rounded; pedal small, distinct. *Dist.*—Australia, New Zealand, Philippines, India, West Africa, Canaries, Brazil.

(lxxxix.) Family ASTARTIDÆ.

Shell *thick, solid, equivalve,* the cardinal teeth always well developed, 2—3 in each valve; lateral teeth sometimes present on one or both sides, ligament always external, strong; muscular scars ovate, the anterior usually with a small deep superimposed pit, produced by the retractile muscles of the foot; pallial line entire.

Genus CARDITA. (665-668.)

Shell oblong, *radiately ribbed;* ligament external; *margins toothed;* hinge-teeth 1·2, and an elongated posterior tooth; *pallial line simple;* anterior pedal scar close to adductor. *Dist.*—Universal.

Genus MYTILICARDIA. (669-670.)

Shell *elongated, very inequilateral,* with *squamous radiating ribs;* hinge with an anterior triangular cardinal tooth; posterior cardinal tooth double in the left valve; no anterior laterals. Foot rounded, grooved, byssiferous. *Dist.*—Universal.

(xc.) Family UNIONIDÆ.

Genus UNIO. (671.)

Shell *nacreous; epidermis thick and dark, oval or elongated, smooth,* corrugated, or spiny, becoming very solid with age; anterior teeth 1·2, or 2·2, short, irregular; posteror teeth, 1·2, elongated, laminar. *Dist.—Fresh water.* Universal.

(xci.) Family TRIGONIIDÆ.

Genus TRIGONIA. (672.)

Shell *trigonal, nacreous internally,* thick, *tuberculated* or ornamented with *radiating or concentric* ribs; posterior side angular; ligament small and prominent; hinge-teeth 2·3, *diverging, transversely striated; centre tooth of left valve divided;* pedal impressions in front of the posterior adductor, and one in the umbo of the left valve; anterior adductor impression close to the umbo; pallial line simple. *Dist.*—Australia.

(xcii.) Family NUCULIDÆ.

Shell oval, or *trigonal, small, nacreous within*; hinge composed of a *great number of transverse teeth*, interrupted by a *central pit* for the reception of the ligament, which is internal or external.

Genus NUCULA. (673-674.)

Shell *trigonal*, with the umbones turned towards the short posterior side, smooth or sculptured; *epidermis olive, interior pearly*; margins *crenulated*; hinge *with prominent internal cartilage pit*, and a series of sharp teeth on each side; *pallial line simple*. *Dist.*—Northern and Arctic Seas; 10—180 fathoms; Siberia, Melville Island, New England, Britain, Mediterranean, Cape, Japan, Australia.

Genus LEDA. (675-676.)

Shell resembling Nucula; oblong, rounded in front, produced and pointed behind; margins even; *pallial line with a small sinus*; umbonal area with a linear impression joining the anterior adductor. *Dist.*—Northern and Arctic Seas; 10—180 fathoms; Siberia, Melville Island, New England, Britain, Mediterranean, Cape, Japan, Australia.

(xciii.) Family ARCIDÆ.

Shell regular, equivalve, with *strong epidermis*; ligament exterior, occupying an area between the beaks; *hinge with a long row of similar comb-like teeth*; pallial line distinct; muscular impressions sub-equal; structure corrugated, with vertical tubuli in rays between the ribs of striæ.

Genus ARCA. (677-681.)

Shell equivalve, or nearly so, thick, *sub-quadrate*, ventricose, strongly ribbed or cancellated; margins smooth or dentated, close or sinuated ventrally; hinge straight, teeth very numerous transverse; umbones anterior, separated by a flat, lozenge-shaped ligamental area, with numerous cartilage grooves; pallial line simple; posterior adductor impression double; pedal scars two, the posterior elongated. *Dist.*—World-wide, most abundant in warm seas; low-water, 230 fathoms.

Genus PECTUNCULUS. (682-685.)

Shell *orbicular*, nearly equilateral, smooth or radiately striated; umbones central, divided by a striated ligamental area; hinge with a semi-circular row of transverse teeth; adductor sub-equal; pallial line simple;

margins crenated inside. *Dist.* — West Indies, Britain, India, New Zealand, West America; ranging from 8 to 60, rarely 120 fathoms.

Genus Limopsis. (685.)

Shell orbicular, convex, *slightly oblique*, ligamental area with a *triangular cartilage pit* in the centre; hinge with two equal curved series of transverse teeth. *Dist.*—Red Sea (Nyst.), Japan, Britain, Tasmania. Mr. M'Andrew has dredged L. *Pygmæa* living on the coast of Finmark.

(xciv.) Family Mytilidæ.

Shell equivalve, *oval or elongated*, closed, umbones anterior, *epidermis thick and dark*, often filamentose; *ligament internal*, sub-marginal, very long; *hinge edentulous*; outer shell-layer obscurely prismatic-cellular; *inner more or less nacreous*; pallial line simple; anterior muscular impression small and narrow; posterior large, obscure.

Genus Mytilus. (686-691.)

Shell *wedge-shaped*, rounded behind, smooth in the typical species; umbones terminal, pointed; hinge-teeth minute or obsolete; pedal muscular impressions *two in each valve*, small, simple, close to the adductors. *Dist*—World-wide, Ochotsk, Behring's Sea, Russian Ice-meer, Black Sea, Cape Horn, Australasia.

Genus Modiola. (692-694.)

Shell *oblong, inflated in front*; umbones anterior, obtuse; hinge toothless; pedal impressions *three in each valve*, the central elongated; epidermis often produced into long beard-like fringes. *Dist.*—Universal.

Genus Modiolaria. (695.)

Shell rhomboidal, sculptured by two rows of striæ (one on each side), which radiate from the beaks, leaving the middle portion smooth; umbones incurved; hinge edentulous or crenulated, hinge-plate finely notched. *Dist.*—Temperate and Arctic Seas.

(xcv.) Family Aviculidæ.

Shell *inequivalve, very oblique*, resting on the smaller (right) valve, and attached by a byssus; epidermis indistinct; outer layer prismatic-cellular, *interior nacreous*; posterior muscular impression large, sub-central, anterior small within the umbo; pallial line irregularly dotted; hinge-line straight, elongated; umbones anterior, eared, the posterior ear wing-like; cartilage contained in one or several grooves; *hinge edentulous cr obscurely toothed.*

Genus AVICULA. (696-697.)

Shell *obliquely oval, often thin diaphanous*, very inequivalve, *eared*, the *posterior ear produced wing-like*; right valve with a byssal sinus beneath the anterior ear; cartilage pit single, oblique; hinge with one or two small cardinal teeth, and an elongated posterior tooth, often obsolete; posterior muscular impressions (adductor and pedal) large, sub-central; anterior (pedal scar) small, umbonal. *Dist.*—Mexico, South Britain, Mediterranean, India, Pacific, Australasia; 20 fathoms.

Genus CRENATULA. (698.)

Shell *thin, oblong compressed*, byssal sinus obsolete; cartilage pit shallow, crescent-shaped. *Dist.*—N. Africa, Red Sea, China, in sponges.

Genus VULSELLA. (699.)

Shell *oblong, striated*, sub-equivalve, *with an inner pearly and outer fibrous layer;* umbones straight, earless. Often found imbedded in living sponges. *Dist.*—Red Sea, India, Australia, Tasmania.

(xcvi.) Family PINNIDÆ.

Genus PINNA. (700.)

Shell equivalve, *wedge-shaped;* umbones quite anterior; posterior side truncated and gaping; ligamental groove linear, elongated; hinge edentulous; anterior adductor scar apical, posterior sub-central, large, ill-defined pedal scar in front of posterior adductor. *Dist.*—U. S., Britain, Mediterranean, New Zealand, Tasmania, Australia, Pacific, Panama.

(xcvii.) Family SPONDYLIDÆ.

Genus SPONDYLUS. (701.)

Shell *irregular*, attached by the right valve, *radiately ribbed, spiny or foliaceous;* umbones remote, eared; ower valve with a triangular hinge-area, cartilage lin a central groove, nearly or quite covered; hinge of two curved interlocking teeth in each valve; adductor impression, double. *Dist.*—West Indies, Canaries, Mediterranean, India, Australasia, Torres Straits, Pacific, W. America, 105 fathoms.

(xcviii.) Family Pectinidæ.

Genus Pecten. (702-706.)

Shell *sub-orbicular*, regular, resting on the right valves, usually ornamented with *radiating ribs;* beaks approximate, *eared;* anterior ears most prominent; posterior side a little oblique; right valve most convex, with a notch below the front ear; hinge margins straight, united by a narrow ligament; cartilage internal, in a central pit; adductor impressions double, obscure; *pedal impression only in the left valve, or obsolete. Dist.*—World-wide, Nova-Zembla, Cape Horn; 200 fathoms.

(xcix.) Family Limidæ.

Shell *eared*, white, gaping at the sides; hinge edentulous, with a *central, triangular cartilage-pit.*

Genus Lima. (707-708.)

Shell equivalve, compressed, *obliquely oval;* anterior side straight, gaping, posterior rounded, usually close; umbones apart, eared; valves white, smooth, punctate, striate, or radiately ribbed and imbricated; there is usually a thin, brownish epidermis; hinge-area triangular, cartilage-pit central; adductor impression lateral, large, double; pedal scars two, small. *Dist.*—Norway, Britain, West Indies, Canaries, India, Australia, 1-150 fathoms. The largest living species (*L. excavata*, Chemn) is found on the Coast of Norway.

(c.) Family Anomiidæ.

Genus Placunanomia. (709.)

Shell adherent, sub-equivalve, *irregular, flattened;* hinge with two thick divergent elongated lamella in the inferior, corresponding with two long pit in the upper valve; upper valve with only two muscular impressions, the pedal scar radiately striated; the byssal plug is often fixed in the lower valve, and its muscle becomes (functionally) an adductor. *Dist.*—West Indies, Britain, New Zealand, California, Behring's Sea, Ochotsk; 50 fathoms. Mocine, California. *P. macrochissna*, Desh.

(ci.) Family Ostreidæ.

Genus Ostrea. (701-713.)

Shell *irregular*, attached by the left valve; upper valve *flat or concave*, often plain; lower *convex*, often plaited or foliaceous, and with a prominent beak; ligamental cavity triangular or elongated; hinge toothless; structure *sub-nacreous*, laminated with prismatic-cellular substance between the margins of the laminæ. *Dist.*—Tropical and temperate seas, Norway, Black Sea, Australasia, etc.

BRACHIOPODA.

(cii.) Family Terebratulidæ.

Shell *minutely punctate;* usually round or oval, smooth or striated; ventral valve *with a prominent beak, perforated near or at the apex,* and attached by a portion of the valve itself; hinge with two curved teeth; dorsal valve with a depressed umbo, a prominent cardinal process between the dental sockets, and a *slender shelly loop.* (*Lamp shell.*)

Genus Waldheimia. (714.)

Shell *smooth or plaited,* dorsal valve frequently impressed; *foramen complete;* loop elongated or reflected; septum of smaller valve elongated. *Dist.*—Norway, West Indies, Java, Australia, California, Cape Horn; low water, 100 fathoms.

Genus Kraussia. (715-716.)

Shell small, *transversely oblong;* hinge-line nearly straight; beak truncated, laterally keeled; area flat; *foramen large, deltidium rudimentary;* dorsal valve longitudinally impressed, furnished inside with a forked process, rising nearly centrally from the septum; interior often strongly tuberculated. The Apophyses are sometimes a little branched. *Dist.*—S. Africa, Sydney, New Zealand; low-water to 120 fathoms. K. *rubra*, Pallas.

DESCRIPTIVE TERMS.

Explanation of Terms Commonly Used in Describing the External Characters and Forms of Various Kinds of Shells.

Shells are said to be *external* when the animal is contained in them, and *internal* when they are concealed in the mantle; the latter, with many species devoid of shelly covering, are termed *naked* mollusca. The greater number of shells have but one shell (usually a closely-set spiral tube or cone,) and are termed *univalves;* the others are mostly composed of two valves (*bivalve*) hinged together, generally under the *beak or* *umbo.* Some bivalves, as in Pholas and Barnea, have one or two accessory plates near the hinge, while the Chitons have eight imbricating valves like an articulated limpet, and are termed *multivalves.* The conical or flatly conical shells of the limpet group are usually *simple* and not *spiral.* The following are a list of terms applied to the principal distinguishing character of shells generally.

UNIVALVES.

FORM OF SHELL.

		*Example fig. No.
I. (*a*)	Regularly spiral.	
1.	Elongated, subulate, elevated	32
2.	Turreted, turriculate, an elongated shell with the whorls angulate or shouldered on their upper part	33
3.	Cylindrical, pupiform	44, 45
4.	Short, bucciniform	5
5.	Fusiform, spindle-shaped	2, 3
6.	Contabulate, short, with shouldered whorls	—
7.	Globular, rounded	16
8.	Depressed, lenticular	19
9.	Discoidal, having the form of a disc or quoit	21, 22
10.	Convolute, aperture about as long as the shell, nearly or quite concealing the spire	24, 25, 26, 28
11.	Trochiform, pyramidal, conical, with a flat base	11
12.	Turbinated, conical, with rounded base	9, 18
13.	Cone shaped, obconic	27
14.	Few whorled, whorls rapidly increasing	13, 36
15.	Many whorled, whorls slowly or gradually increasing	12, 39
16.	Ear-shaped	23
17.	Subulate, awl-shaped	38
18.	Acicular	40
(*b*.)	Irregularly spiral, evolute	31
(*c*.)	Tubular, tusk-like, tooth-like	46
(*d*.)	Boat-shaped, slipper-shaped	14, 15
(*e*.)	Conical or limpet-shaped	57, 58, 59
(*f*.)	Multivalve and imbricated	47

* See accompanying Plate.

Divisions of the Shell.

	Example fig. No.
II. Apex, the posterior end of shell, or *nucleus*	5^a
1. The *nucleus* may be *reversed* or *sinistral*, turning to the left as in the body whorls of Physa	
2. Dextral, turning to the right, normal condition	
3. Oblique, when the nuclear whorls are set at an angle, unconformable with the body whorls	
III. Whorl, a single complete revolution of the spiral cone	11^a
1. Periphery, that part marking its greatest circumference	8^a 21^a
2. Suture, the line of channel formed by the junction of the whorls	5^c
3. Body-whorl usually capacious, the last turn ending with the aperture	36^a
IV. Base, anterior extremity opposite end to apex, usually the front of the aperture	11^a
1. Oblique, as in	20
2. Concave, as in	20
3. Convex, as in	19
4. Flat, as in	11-12
V. Aperture, the open mouth of the shell, the interior of which may be simple or entire, or may be channeled by a gutter or canal, more or less produced or everted (2.3). The aperture is:—	
1. Longitudinal, when its greatest diameter is parallel to the axis of whorls	27
2. Transverse, reverse of longitudinal	13
3. Oblique, greatest diameter oblique to the axis	37
4. Rounded, the circle slightly interrupted	9
5. Auriform, ear-shaped	35
6. Ovate, egg-shaped	36
7. Oblong, rounded above and below, longer than wide	17
8. Lunate, semi-lunar, semi-circular	16
9. Triangular	

Example fig. No.

10. Linear, narrow 26
11. Quadrate, squarish 13
12. Patulous, dilated at its entrance ...
13. Compressed, diminished at its entrance ... ...
14. Produced, lengthened out 2d 3e
15. Sometimes truncated, stunted, cut short abruptly at the end ... 5, 6, 33-34

VI. Peristome. Sometimes peritreme. Margin of aperture. It is :— ...
1. Continuous or entire, as in ... 8, 9, 21, 44
2. Interrupted, when the left side of aperture is formed only by the body-whorl 5
3. The left side is formed either by the *inner* or *columella lip* (labrum) or partly by the body-whorl or *parietal wall.* The right side is formed by the *outer lip (labrum.)*

VII. Outer lip may be :—
1. Thin and sharp 7
2. Thickened 1
3. Reflected, curled outwards 8
4. Inflected, curled inwards 25
5. Expanded, swollen 1
6. Digitate.
7. Foliated, fringed with spines.
8. Emarginate, incised, or slit 3a
9. Effuse, when basal or anterior extremity is slightly produced, depressed, or reflected ... 32, 33, 34
10. Sinuous, bent or curved interiorly. It may be :— ...
11. Dentate, toothed 3, 29
12. Plicate or lamellate, when the teeth become rib-like.
13. Ringent, having *large* plications, nodules or teeth.
14. Deflected, deflexed, bent aside or backwards.

VIII. Inner lip or columella margin may have characters like those described under outer lip.

IX. Umbilicate. Perforate. When the base of the axis or columella, around which the whorls are coiled, is open

Example fig. No.

or hollow (12^a.) It is ***sub-umbilicated***, or ***sub-perforate*** when partly covered over by shelly matter (16). It is not umbilicated or non-perforate, where the axis of the shell is solid.

SCULPTURE OR COLOUR MARKINGS.

X. These are :—

1. Longitudinal, when taking the direction of the axis.
2. Revolving or transverse, when they follow the spiral.
3. Canaliculate. Suture deeply channeled 5
4. Cingulate. Encircled by revolving ribs 9
5. Carinate, revolving sculpture prominent, sharp 9
6. Sulcate, encircled by channels 10, 11
7. Plicate, costate, ribbed. Sculpture longitudinal 4, 5, 8
8. Nodosely, tuberculately, granosely plicate, when the ribs are broken up into tubercles or granules; mostly caused by the intersection of revolving sculpture 9
9. Striate, covered by fine close lines, either longitudinal or revolving.
10. Punctate, pitted. Frequently punctate, striate, *i.e.*, 9 & 10 combined ... 11
11. Granulate, nodose, tuberculate, covered with nodules of small or large size, but *not ribbed* 3
12. Muricate, spinous, echinate when the nodules are *sharp pointed.*
13. Decussate, cancellate, longitudinal and revolving sculpture, crossing at *right angles.*
14. Reticulate, sculpture not crossing at right angles, irregularly decussate.
15. Clathrate, longitudinal and revolving lines both distant, forming a pattern somewhat like the iron bars of a prison window.

Example fig. No.

16. Coronate, the upper part of the whorls having a series of revolving tubercles or spines 4
17. Varicose, when the external thickening of the outer lip of aperture occuring in some shells during rest-periods is not absorbed when growth is resumed, but remains crossing the whorls, rib-like, at regular intervals 1

XI. Operculum. A horny or shelly lid which closes the aperture of a large number of univalve shells. It is .—

1. Concentric when nucleus is central or sub-central.
2. Imbricated or lamellar when nucleus is marginal.
3. Claw-shaped or unguiculate, nucleus apical of in front.
4. Spiral, revolving gradually and growing on one edge.
5. Pauci-spiral, few rapidly increasing whorls.
6. Sub-spiral, scarcely spiral.
7. Multi-spiral, many whorled.
8. Articulated when it has a projection.
9. Radiated, modification of the articulated form in which the spiral is not so evident.

BIVALVES.

XII.

Arcuated, bent in the form of an arch.
Auriform, ear-shaped.
Auricled, having appendages like ears. ... (53)
Byssus, a beard.
Gibbous, bulging, swollen.
Compressed, squeezed together.
Concamerated, arched over, vaulted.
Concave, hollowed out ... ...
Concentrically rayed or ribbed, curved, with the umboe as a centre.
Cordate, cordiform, heart-shaped.
Crenulated, notched at the margin, scalloped ... ... (53)

Example fig. No.

Cuneiform, wedge-shaped ... ... (55)

Cylindrical, round, like a roller or cylinder.

Cymbiform, boat-shaped.

Denticulated, set with small teeth as in Arca.

Dexter valve, right valve.

Divaricated, spreading out widely.

Dorsal margin, the side on which the hinge is placed.

Elliptical, having the form of an ellipse.

Elongated, lengthened, drawn out.

Gap, gaping; when the valves are shut in some bivalves, as in Pholas, an opening is disclosed called the gap.

Globose, globular.

Hemispherical, in the shape of a half-globe.

Inequilateral, when the anterior and posterior sides make different angles with the hinge. *Equilateral*, having both sides alike.

Inequivalve when one valve is more convex than the other, or dissimilar in other respects, as in the common oyster.

Equivalve, having both valves alike.

Lenticulate, doubly convex, of the form of a lens.

Ligament, a solid body, softer than a cartilage, but harder than a membrane, which connects the valves. *External ligament* usually attached to ridges on the posterior, hinge-margin behind the umbones.

In some bivalves, as in Mactra, the ligament is internal, lodged in a cartilage furrow or pit.

Limb, the margin in bivalve shells.

Lobated, rounded at the edge.

Lunule, a crescent-like mark or spot, situated near the anterior and posterior slopes.

Nacred, nacreous, pearly.

Oblong-ovate, egg-shaped or oval.

Obsolete, indistinct, not well defined

Papyraceous, thin as paper.

Example fig. No.

... .

Pectinated, resembling the teeth of a comb.
Pinnated, winged.
Quadrangular, having four right angles.
Radiately, rayed or ribbed, rays or ribs springing from umboe, in the direction of limb or margins ... (52)
Ridge, the upper part of a slope.
Scalloped, indented at the edges.
Serrated, having teeth like a saw.
Serrulated, very minutely serrated.
Sub-arcuated, somewhat arched.
Sub-diaphanous, somewhat transparent.
Transverse, breadth greater than length.
Trapeziform, shaped like a trapezium.
Trigonal, having three angles, deltoid.
Turgid, swollen.
Ventral margin, the margin opposite the hinge-margin.
Ventricose, inflated or swelled in the middle.
Umbo, the beak or round part which turns over the hinge.

NOTE.—Many of the terms relating to the sculpture of univalves, are also applicable to the sculpture of bivalves.

LENGTH, BREADTH AND THICKNESS.

The hinge line of bivalves indicates the direction of the *length* of the shell, and the actual length is the maximum distance between lateral margins.

The breadth is the greatest diameter measured transversely to length.

The thickness is the greatest diameter of an imaginary line passing through one or both valves.

LIGAMENT.

The *valves* of the Pelecypods are bound together by a *ligament*, (49^{c}) and usually articulated by a *hinge* furnished with interlocking teeth. The shell is closed by (either one or two) powerful *adductor muscles* (53^{a}) but opens spontaneously by the action of the *ligament* when the animal relaxes, and after it is dead.

UMBO.

The *apex, beak or umbo* (49^d) is the point from which the growth commences and is situated near the hinge. The beaks are either straight, as in Pecten, curved as in Venus or Cardium, or spiral, as in Isocardia.

RIGHT AND LEFT VALVE.

When a shell is placed so that the dorsal margin is furthest from the observer, with the exterior side of valve uppermost, the position of the ligament to the right indicates the left valve, if to the left the right valve.

The *lunule* is a small cordate or semicircular impression under and anterior to the beaks. When this appears to the right the valve is right, and *vice-versa.*

The *sinus* or *flexure* (fig. 49^e) of the pallial impression (48^c) when present is seen under the ligament. When the inside surface is viewed with the dorsal margin furthest from observer, if to the right it indicates the right valve, and *vice-versa.* Sometimes there are posterior lateral teeth, or laminæ of the hinge-margin, and are found on the right or left side accordingly as the valve is right or left. Thus the *pallial sinus*, the *external ligament*, (49^c) and the *posterior slope* (49^a) are to the right side, (the internal surface being exposed with the beak furthest from observer,) in the *right valve* (49), and *vice-versa.*

Linnæus and the older naturalists were wont to describe the front of the shell as the back and the right valve as the left.

HINGE-LINE AND TEETH.

The dorsal margin on which the ligament and teeth are situated is termed the *hinge-line*. It is long and straight in Arca, short in Vulsella, and curved in most genera.

The central teeth immediately under umbo are called *hinge* or *cardinal* teeth (48^{a}), those on each side are *lateral* teeth (48^{b}), either the *cardinal* or the *lateral* teeth may be lacking in many shells, while in some teeth are entirely absent.

EDENTULOUS.

The dentition formulæ are usually stated as follows:—Cardinal teeth 2·3 or $\frac{2}{3}$—meaning 2 in the *right* valve, 3 in the left; lateral teeth, 1—1, 2—2, or 1 anterior and 1 posterior in *right* valve, 2 anterior, and 2 posterior lateral teeth in the *left* valve.

ADDUCTOR OR MUSCULAR IMPRESSIONS. ($49^{t.s.}$)

The greater number of bivalves have two *adductor muscles*, whose *impressions or scars* on the shell, nearly equal in size, are situated respectively on the anterior and posterior sides at the extremities of the hinge-line. In Mytilus, Modiola, these two *adductor impressions* are unequal, the posterior one being very much larger. In the Pectens, Oysters and Limas, there is only *one* strong *adductor impression* (53^{a}), placed more centrally. The single *muscular scar is* not quite central, but nearer the posterior than the anterior side.

EPIDERMIS. SCARF OR SKIN.

All bivalve shells are clothed with an *epidermis*, *scarf*, or *skin*. Inconspicuous in some, but remarkably developed in others.

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27	——————*Census* of New Tasmanian Marine Shells	*1877
28	——————Fresh water Shells of Tasmania ...	*1875
29	——————On some Marine Shells (recent additions not embraced in Census)	*1877
30	——————Observations on *Patellidæ and Nudibranchiata*, and Ampullaria (?) Amnicola...	*1876
31	——————On some new Marine Shells (not embraced in Census.) (Roy. Soc. Vic.)	1877-8
32	——————On some Tasmanian Trochidæ ...	*1879
33	*Johnston, R. M.*—Further notes on Tasmanian Fresh Water Shells, with descriptions of seven new species	*1877
34	——————Notes on the distribution and variability of Tasmanian Land Shells	*1878-9

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35	*Johnston, R. M.*—Table showing the general distribution of Tasmanian Land Shells	*1879
36	*Tenison - Woods*—On some Tasmanian Fresh Water Shells	*1878
37	————————On some new Marine Mollusca. (Roy. Soc. Vic.)	1877

* *Published in Proc. Roy. Soc. of Tas. in each year as stated.*

Index No.		Year of *Publication.*
38	Beddome, Lieut. C.E.—Description of three new Helices. (Proc. Roy. Soc. Tas.)	1878-9
39	*Johnston, R. M.*—Note on the discovery of *Turbo circularis* on Flinder's Island, and of the habitat of *Amnicola* (*Ampullaria ?*) *Tasmanica*, T. Woods ; also a description of a new species of Helix. (Proc. Roy. Soc. Tas.) ..	1878-9
40	*Petterd, W.*—A Monograph of the Land Shells of Tasmania, describing 79 species	1878-9
41	*Tenison-Woods*—Notes on *Bithynella*, etc. (Proc. Roy. Soc. Tas.)	1879
42	*Tate, Prof. Ralph*—On some Australian Slugs. (Proc. Roy. Soc. Tas.)	1880
43	Beddome, Lieut. C.E.—Description of two new Marine Shells. (Proc. Roy. Soc. Tas.)	1881
44	Tate, Prof. Ralph—Type species of Tasmanian Shells. (Proc. Roy. Soc. Tas.)	1881
45	*Tate and Brazier*—Check list of the Fresh Water Shells of Australia. (Proc. Linn. Soc., N.S.W.)	1881
46	*Hutton, Prof., F. W.*—Manual of the New Zealand Mollusca. (Wellington.)	1880
47	*Hutton, Prof., F. W.*—Notes on New Zealand *Hydrobiinæ*, *Pulmonate* Mollusca, etc. (Trans. N. Z. Institute) ...	1881
48	*Johnston, R. M.*—Notes on the discovery of a species of Pupa (*P. Lineolensis*) at Swansea, not hitherto recorded as existing in Tasmania. (Proc. Roy. Soc. Tas.) ..	1882
49	*Beddome, Lieut. C.E.*—Description of some new Marine Shells. (Proc. Roy. Soc. Tas.)	1882
50	*Smith, Edgar A.*—On the Fresh Water Shells of Australia. (Jour. Linn. Soc. Zool. xvi.-92)	1882
51	*Johnston, R. M.*—Notes regarding certain Fossil Shells occurring at Table Cape, supposed to be identical with living species. Two communications. (Proc. Roy. Soc. Tas.)	1884
52	*Tate, Prof. Ralph*—Critical examination of the Mollusca of the Older Tertiary of Tasmania, alleged to have living representatives. (Proc. Roy. Soc. Tas.) ...	1884
53	*Petterd, W. F.*—New species (5), of Tasmanian Marine Shells. Two papers. (Proc. Roy. Soc. Tas.) ...	1885
54	*Tate, Prof. Ralph*—On the Australian Pectens, confounded with the New Zealand *P. laticostatus*. Gray. (Proc. Roy. Soc. Tas.)	1886
55	*Brazier, John*—The Trochidæ and other Genera of Mollusca from Tasmania, with their synonyms. (Proc. Roy. Soc. Tas.)	1886
56	*Johnston, R. M.*—Notes with respect to the Land and Fresh Water Mollusca of King's Island. (Proc. Roy. Soc. Tas.)	1887

Index No.		Year of *Publication.*
57	*Petterd, W. F.*—Contributions for a Systematic Catalogue of the Acquatic Shells of Tasmania. (Proc. Roy. Soc. Tas.)	1888
58	*Johnston, R. M.*—Critical Observations on recent contributions to our knowledge of the Fresh Water Shells of Tasmania. (Proc. Roy. Soc. Tas.)	1888
59	——————Observations on the variability of the Tasmanian Unio. (Proc. Roy. Soc. Tas.)	1888
60	*Tenison-Woods*—On the Anatomy and Life History of Mollusca peculiar to Australia. Prize Essay. (Roy. Soc. N.S.W.)	1888
61	*Tate, Prof. Ralph*—Supplement to a list of the Lamellibranchs and Palliobranchs, etc., of South Australia, with a census of the Molluscan Fauna of Australia. (Trans. Roy. Soc. S.A.)	1888

CLASSIFIED LIST OF SPECIES.

(The numbers to the extreme right refer to index number of the publications containing fuller particulars or descriptions recorded in the Bibliography pages 71, 72.)

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2	Pinnoctopus cordiformis. *Quoy*	46

(ii.) Family ARGONAUTIDÆ. (sp. 1.)

3*	Argonauta tuberculata. *Shaw*	27, 46

(iii.) Family LOLIGNIIDÆ. (sp. 2.)

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	———— bilineata. *Quoy and Gaim.*	46

(iv.) Family ONYCHOTEUTHIDÆ. (sp. 2.)

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7*	Spirula Peronii. *Lam.* (*D. Lævis Gray*)	27

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11	——— Angasi. *Crosse*	27
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13	Typhis arcuatus. *Hind's Voyage of Sulphur*	*27
14	Trophon umbilicatus. *T.-Woods*	*27
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19	——— Mariæ. "	27
20	——— Hanleyi. "	27
21	——— Goldsteini. "	27
22	——— Australis. "	27
23	Purpura textilosa. *Lam.*	27
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25	——— succincta. *Martyn*	27
26	——— madreporarum. *Sow.*	27
27	——— (?) littorinoides. T.-Woods	27
28	——— propinqua. T.-Woods	27

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29	Triton cutaceus. *Linne*	27
30	——— *Spengleri. Dillwyn.* (Regarded by *T.-Woods* as a variety of *T. cutaceus*	27
31	——— *Waterhousei. Ad. and Angas.* May also be simply a small variety of T. cutaceus	27
32	——— Quoyi. *Reeve*	27
33	——— subdistortus. *Lam.*	27
34	Ranella leucostoma. Lam.	27
35	——— *vexillum ? Sow.*	27
36	——— epitrema. T.-Woods	27

(ix.) Family Fusidæ. (sp. 9.)

37	Fusus dilatata. *Quoy and Gaim.*	27
38	——— pyrulatus. *Reeve, Icon*	27
39	——— Novæ-Hollandiæ. *Reeve, Icon*	27
40	——— Tasmaniensis. *Adams and Angas*	27
41	——— Legrandi. *T.-Woods*	27
42	——— Spiceri. "	27

43	Fasciolaria fusiformis. *Valenc*	27
44	—— coronata. *Lam.*	27
45	—— *trapezium.* Linne. (Reeve considers this form a variety of F. coronata.)	27

(x.) Family Buccinidæ.) (sp. 15.)

46	Siphonalia Clarkei. *T.-Woods*	27
47	—— turrita. *T.-Woods*	27
48	—— fuscozonata. *Ad. and Angas*	27
49	Cantharus, Petterdi. *Brazier.* (*Tritonidæ.* Woods and Brazier)	27
50	Pisania reticulata. *T.-Woods*	27
51	—— Tasmanica. "	27
52	Cominella tenuiscostata. "	27
53*	—— alveolata. *Kiener*	27
54 ?	—— lactea. *Reeve, Icon*	27
55	—— Tasmanica. *T.-Woods*	27
56	—— costata. *Quoy*	27
57	—— Angasi. *Crosse*	27
58	—— albo-lirata. *T.-Woods*	27
59	—— (Josepha), Tasmanica "	27
60	Eburna (Zemira), Australis. *Sow.*	27

(xi.) Family Nassidæ. (sp. 5.)

61	Nassa Fasciata. *Lam.*	27
62	—— pauperata. *Lam.*	27
63	—— rufocincta. *A. Adams*	27
64	—— Jacksoniana. *Kiener*	27
65	—— Tasmanica. *T.-Woods*	27

(xii.) Family Volutidæ. (sp. 7.)

66	Voluta Angasi. *Sow.*	27
67	—— fusiformis. *Swainson*	27
68	—— papillaris. "	27
69	—— mitræformis. *Lam.*	27
70	—— mamilla. *Gray*	27
71	—— *Kingii. Cox.* (Probably only a variety of *V. Angasi*)	27
72	—— Sclateri. *Cox*	27

(xiii.) Family Mitridæ. (sp. 14.)

73	Mitra Badia. *Reeve*	27
74	—— glabra. *Swainson*	27
75	—— Australis. "	27
76	—— pica. *Reeve*	27

77	Mitra declivis. *Reeve.* May be a variety of M. glabra. (T.-Woods)	27
78	—— capensis. *Dunker.* (*M. Weldii.* T.-Woods)	27
79	—— Tasmanica. *T.-Woods*	27
80	—— Scalariformis. "	27
81	—— Legrandi. "	x†
82	—— Teresiæ. "	v†
83	—— scita. "	27
84	—— granatina. *Swainson and T.-Woods*	27
85	—— Franciscana. *T.-Woods*	27
86	—— semilivida "	27

(xiv.) Family MARGINELLIDÆ. (sp. 10.)

87	Erato pellucida. *T.-Woods*	27
88	Marginella Muscaria. *Lam.*	27
89	———— turbinata. *Sow.*	27
90	———— formicula. *Lam.*	27
91	———— Volutiformis. *Reeve*	27
92	———— Tasmanica. *T.-Woods*	27
93	———— Stanislas. "	27
94	———— minutissima "	27
95	———— Allporti. "	27
96	———— Petterdi. *Beddome*	27

(xv.) Family OLIVIDÆ. (sp. 5.)

97	Olivella Australis. *T.-Woods*	27 31
98	Oliva hieroglyphica. Reeve	27
99	Ancillari marginata. *Lam.*	27
100	——— fusiformis. Petterd	53
110	——— obtusa "	53

(xvi.) Family COLUMBELLIDÆ. (sp. 12.)

102	Columbella semi-convexa. *Lam.*	27
103	———— Lincolnensis. *Reeve*	27
104	———— irrorata. "	27
105	———— Roblini. *T.-Woods*	27
106	———— Xavierana. "	27
107	———— Legrandi. "	27
108	———— miltostoma "	27
109	———— badia "	27
101	———— (Aesopus) pilosa. *Angas*	27
111	———— minima. "	27
112	———— dictua. *T.-Woods*	31
113	———— *rosacea (?) Reeve.* Probably identical with C. semi-convexa. *Tate.*)	44

(xvii.) Family CANCELLARIDÆ. (sp. 4.)

114	Cancellari lævigata. *Sow.*	27
115	——— undulata "	27
116	——— Tasmanica. *T.-Woods*	27
117	——— excavata. *Sow.*	27

(xviii.) Family TEREBRIDÆ. (sp. 6.)

118	Terebra bicolor. *Angas.* (*Acus.* Angas and Woods)	27
119	——— (Hastula.) Brazieri. *Angas*	27
120	——— Sp. indet. *T.-Woods*	27
121	——— addita. *Desh.*	27
122	——— Kieneri. "	27
123	——— nitida. Hinds	27

(xix.) Family PLEUROTOMIDÆ. (sp. 29.)

124	Pleurotoma (Drillia) Coxi. *Angas*	27
125	——— " incrusta. *T.-Woods*	27
126	——— " pseudo-carinata. *Reeve*	27
127	——— " *Angasi ?*	27
128	——— " Atkinsoni. *T.-Woods*	27
129	——— " minuta. "	27
130	——— " Weldiana. "	27
131	——— " Beraudiana. *Cross*	27
132	——— " tæniata. *T.-Woods*	27
133	——— " Agnewi. "	27
134	——— " Legrandi. *Beddome*	49
135	——— Bela mitralis. *Ad. and Angas*	27
136	——— (Clathurella) Philomenæ. *T.-Woods*	27
137	——— " granulosissima. "	31
138	——— " sculptilior "	31
139	——— (Daphnella) Tasmanica. *T.-Woods*	27
140	——— " varix. "	27
141	——— (Cythara) Tasmanica "	27
142	——— (Mangelia) St. Gallæ "	27
143	——— " Desalesii "	27
144	——— " Atkinsoni "	27
145	——— " Meredithæ "	27
146	——— " immaculata "	27
147	——— " Le-Tourneuxiana. *Crosse*	27
148	——— " Harrisoni. *T.-Woods*	31
149	——— " delicatula "	31
150	——— " alternata "	31
151	——— " trachys "	31
152	——— " cancellata. *Beddome*	49

(xx.) Family CONIDÆ. (sp. 5.)

153	Conus Novæ-Hollandiæ. *Adams*	27
154	——— pontificalis. *Lam.*	27
155	——— Tasmaniæ. *Sow.*	27
156	——— rutila. ( ) *C. Macleay and T.-Woods*	27
157	——— Carmeli. *T.-Woods*	27

(xxi.) Family CYPRÆIDÆ. (sp. 8.)

158	Cypræa *Annulus. Linne*	27
159	——— angustata. *Gray*	27
160	——— piperata. *Soland.*	27
161	——— Comptoni. *Gray*	27
162	——— (Cyprovula) umbilicata. *Sow.*	27
163	——— *Scotti ? Brod.*	27
164	——— (Trivia.) Australis. *Lam.*	27
165	Ovulum. (Volva.) Maccoyi. *T.-Woods.* (*Birostra.* T.-Woods)	27

(xxii.) Family CASSIDIDÆ. (sp. 5.)

166	Cassia. (Semi-cassis) semigranosa. *Lam.*	27
167	——— " tumida. *Petterd*	53
168	——— (Cassmaria) pyrum. *Lam.*	27
169	——— " *nivea. Brazier.* Regarded by T.-Woods as a variety of *C. pyrum*	27
170	——— (Cassmaria) Paucirugus. *Menke*	27

(xxiii.) Family NATICIDÆ. (sp. 9.)

171	Natica conica. *Lam.*	27
172	——— Beddomei. *R. M. Johnston.* (Proc. Roy. Soc. Tas., 1884. P. 221. *N. polita.* T. Woods.)	27
173	——— Tasmanica. *T.-Woods*	27
174	——— nana. "	27
175	——— Strangei. "	27
176	——— (Mamilla.) umbilicata. Quoy	27
177	——— " globosa. *T.-Woods.* Probably merely a white variety of *N. umbilicata*	27
178	Sigaretus zonalis. *Quoy*	27
179	Lamellaria. Sp. indet. North West Coast. (T. R. Atkinson.)	27

(xxiv.) Family CALYPTRÆIDÆ. (sp. 8.)

180	Infundibulum calyptræformis. *Lam.* (*Trochita,* T.-Woods)	27
181	Legrandia Tasmanica. *Beddome*	43
182	Calyptræa Harrisoni. *Beddome.* (*Cemoria, Beddome*)	43
183	*Crepidula (sp ?)* Waterhouse Island	27
184	——— *(sp ?)* Frederick Henry Bay	27

185	*Hipponyx* foliacea. Quoy. (*Cochlolepas*, T.-Woods) ...	27
186	——— subrufa. Sow. (*Cochlolepas*, T.-Woods ...	27
187	——— (Amalthea) Conica. *Schum.*	27

(xxv.) Family SOLARIIDÆ. (sp. 3.)

188	Solarium, luteum. Lam.	27
189	———. Sp. indet, Recherche	27
190	Adeorbis picta. T.-Woods	27

(xxvi.) Family SCALARIDÆ. (sp. 12.)

191	Scalaria Australis. *Lam.*	27
192	——— (Cirostrema) varicosa. *Lam.*	27
193	——— granulosa. *Quoy*	27
194	——— aculeata. *Sow.*	27
195	——— *delicatula*. *Crosse.*	27
196	——— *Jukesiana*. *Forbes*	27
197	——— lineolata. *Sow.*	27
198	——— *Philippinarum ?* *Sow*	27
199	———.	
200	——— (Crossea) labiata. *T.-Woods*	27
201	——— (") concinna. *Angas, B.*	49
202	——— (") cancellata. *T.-Woods.* (*Delphinula Johnstoni*. Beddome)	49

(xxvii.) Family IANTHINIDÆ. (sp. 3.)

203*	Ianthina communis. *Lam.*	27
204*	——— *exigua*. *Lam.*	27
205	——— bipartita. *Gray ?*	27

(xxviii.) Family TURRITELLIDÆ. (sp. 5.)

206	Turritella Tasmanica. *Reeve*	27
207	——— granulifera. *T.-Woods*	27
208	——— Tasmaniensis. "	27
209	——— acuta. "	27
210	——— sinuata. *Reeve*	27

(xxix.) Family VERMETIDÆ. (sp. 3.)

211	Vermetus dentiferous. *Lam.*	27
212	Siliquaria Australis. *Quoy.* (*Tenagodus*, T.-Woods)	27
213	——— Weldii. *T.-Woods.* (" ")	27

(xxx.) Family EULIMIDÆ. (sp. 8.)

214	Eulima Tasmanica. T.-Woods	27
215	——— micans. "	27
216	——— proxima. *Sow.*	27

217	Eulima marginata. *T.-Woods*	31
218	——— apheles. "	31
219	——— Legrandi. *Beddome*	49
220	——— Petterdi. "	49
221	Stylifer Tasmanica. *T.-Woods*	27

(xxxi.) Family TURBONILLIDÆ. (sp. 12.)

222	Turbonilla *Angasi*. *Angas and T.-Woods*	27
223	——— Mariæ. *T.-Woods*	27
224	——— Macleayana. "	27
225	——— Tasmanica. "	27
226	Aclis tristriata "	27
227	Odostomia Tasmanica "	27
228	——— (Parthenia) Tasmanica. *T.-Woods*	27
229	——— lactea. *Angas*	27
230	——— bifasciata. *T.-Woods*	27
231	Syrnola Michæli. "	27
232	——— bifasciata "	27
233	Eulimella (Styloptygma.) Tasmanica. *T.-Woods*	27

(xxxii.) Family LITTORINIDÆ. (sp. 11.)

234	Littorina unifasciata. *Gray*	27
235	——— paludinella. *Reeve*	27
236	——— Hisseyana. *T.-Woods*	27
237	——— *undulata ?* *Gray*. Probably a variety of *L. unifasciata*	27
238	——— *Philippi ?* *Carpenter*	27
239	Risella nana. *Lam.*	27
240	——— melanostoma. *Gmelin*	27
241	——— *aurata ?* H. and A. Adams. Regarded by T.-Woods as a variety of *R. melanostoma*	27
242	Fossarus (Fossarina.) Petterdi. *Crosse*	27
243	——— Tasmanicus. *T.-Woods*	27
244	——— bulimoides. "	27

(xxxiii.) Family PLANAXIDÆ. (sp. 3.)

245	Alaba (Diala) monile. *A. Adams*. (*D. tessellata*. T.-Woods	27
246	—— " lauta. " (*D. punctata*. T.-Woods	27
247	—— " tumida. T.-Woods	27

(xxxiv.) Family CERITHIIDÆ. (sp. 15.)

248	Cerithium dubium. *Sow.* Tate states that Sowerby's name has priority over *C. monachus*. C. and Fisch	27, 44
249	——— rhodostoma. *Adams*	27
250	——— serotina. *A. Adams*	27

251	Cerithium *Diemense. Quoy and Gaim.* (Tate, P. 31-32. Proc. Roy. Soc. Tas., 1881.)	27
252	——— (Bittium) granarium. *Kiener*	27
253	——— " turritella. *Quoy*	27
254	——— " Lawleyanum. *Crosse*	27
255	——— " minimum. *T.-Woods*	31
256	——— " turboniloides. "	31
257	——— " semi-lævis "	31
258	——— (Cerithiopsis.) Atkinsoni. " (Perhaps a variety of *C. crocea* Angas)	27
259	——— " albosutura. *T.-Woods*	27
260	Triforis fasciata. T.-Woods	31
261	——— Tasmanica. "	27
262	Potamides (Lampania) Australis. *Quoy*	27

(xxxv.) Family Rissoellidæ. (sp. 1.)

263. Tatea rufilabris. *A. Adams.* (*Tatea Huonensis.* T.-Woods. *Diala.* Adams.)

(xxxvi.) Family Rissoidæ. (sp. 48.)

264	Rissoina variegata. *Angas*	27
265	——— cincta. "	27
266	——— nivea. "	27
267	——— turricula. "	27
268	——— St. Claræ. *T.-Woods*	27
269	——— Flindersii. "	27
270	——— concatenata. "	27
271	——— Gertrudis "	27
272	——— Kershawi. "	31
273	——— supra-sculpta. "	31
274	——— uni-cirata. "	31
275	Rissoa Agnewi. "	27
276	——— cyclostoma. " var. *a rosea*	27
277	——— melanura. "	27
278	——— Angeli. " (Cyclostrema ?)	27
279	——— (Setia) Brazieri. "	27
280	——— " siennæ. *Assiminea Tasmanica.* T.-Woods	27
281	——— " Flamina. *Beddome*	49
282	——— (Cingula) Atkinsoni. *T.-Woods*	27
283	——— (Ceratia) Maccoyi. "	27
284	——— " puncto-striata. "	31
285	——— " Mariæ. "	27
286	——— (Alvania) cheilostoma. "	27
287	——— " fasciata. "	27
288	——— " Bayntoni "	49
289	——— minutissima. *T.-Woods*	27
290	Hydrobia *cristallina ? Pfr.* Petterd, Proc. Roy. Soc. Tas., 1888	57, 58

291	Hydrobia *Gunni ? Frauenfeld.* Tate and Brazier, Proc. Linn. Soc., N.S.W., 1881	57, 58
292	Hydrobia *Tasmanica ? Martins.* Petterd, Proc. Roy. Soc. Tas., 1888	57, 58
293	Hydrobia, turbinata. *Petterd*	57, 58
294	Bithynella (Potomapyrgus ?) nigra. *Quoy and Gaim* ...	57, 58
295	——— „ ? nitida. *R. M. Johnston.* (Fossil)	58
296	——— „ ? Dulvertonensis. T.-Woods...	57, 58
297	——— „ ? Dunrobinensis. „ ...	57, 58
298	——— „ ? Dyeriana. *Petterd* ...	57, 58
299	——— „ ? Simsoniana. *Brazier* ...	57, 58
300	——— „ ? Woodsii. *Petterd*... ...	57, 58
301	——— „ ? Smithii. „	57, 58
302	——— „ ? Brownii. „	57, 58
303	——— „ ? marginata „	57, 58
304	Amnicola ? (Brazieria) Tasmanica. *T.-Woods* (Amnicola)	57, 58
305	——— (Beddomeia) Diemense. *Frauenfeld.* Previously referred to *Amnicola* ...	57, 58
306	——— „ Launcestonensis. *R. M. Johnston.* Referred to Petterd's new Subgenus Beddomeia	57, 58
307	——— „ Bellii. *Petterd*...	57, 58
308	——— „ Lodderæ. „	57, 58
309	——— „ Hulli. „	57, 58
310	——— „ Tasmanica. *T.-Woods.* *Valvata,* T.-Woods	57, 58
311	Pomatiopsis striatula. *Menke*	57, 58
312	——— Badgerensis. *R. M. Johnston*	57, 58

(xxxvii.) Family ASSIMINIIDÆ. (sp 1.)

313	Assiminea bicincta. *Petterd*	57

(xxxviii.) Family VALVATIDÆ. (sp. 1.)

313a	*Valvata Tasmaniæ.* *T.-Woods.* Beddomeia Tasmanica	57

(xxxix.) Family TRUNCATELLIDÆ. (sp. 4.)

314	Truncatella scalarina. *Cox.* Petterd's Monograph ...	27
315	——— Tasmanica. *T.-Woods.* Petterd's Monograph	27
316	——— marginata. Kuster. „ „	27
317	——— micra. T.-Woods. „ „	27

(xl.) Family NERITIDÆ. (sp. 1.)

318	Nerita atrata. *Quoy*	27

(xli.) Family LIOTIIDÆ. (sp. 15.)

319	Liotia Tasmanica. *T.-Woods*	27
320	—— discoidea. "	27
321	—— Australis. "	27
322	—— Angasi. "	27
323	—— minima. "	31
324	—— annulata. "	31
325	Cyclostrema *Kingii*. *Brazier*	27
326	———— Josephi. *T.-Woods*	27
327	———— micra. "	27
328	———— Weldii. "	27
329	———— Susonis. "	27
330	———— Spinosa. "	27
331	———— immaculata "	27
332	———— Bruniensis. *Beddome*	49
333	———— Johnstoni. "	49

(xlii.) Family ROTELLIDÆ. (sp. 1.)

334	Rotella (Ethalia) Tasmanica. T.-Woods	x

(xliii.) Family PHASIANELLIDÆ. (sp. 5.)

335	Phasianella tritonis. *Chemnitz*	27
336	———— sanguinea. *Reeve*	27
337	———— Angasi. *Jour. Conch, 1864*	27
338	———— rosea. *Angas*	27
339	———— delicatula. *T.-Woods*	27

(xliv.) Family TURBINIDÆ. (sp. 3.)

340	Turbo (Marmorostoma) undulatus. *Chemnitz* ...	27
341	——— (Senectus) circularis. *Reeve*	27
342	——— straminea. *Martyn*	27

(xlv.) Family TROCHIDÆ. (sp. 46.)

343	Trochus tæniata. *Quoy and Gaim.*	27
344	——— (Gibbula) Coxi. *Angas*	27
345	——— " sulcosa. *A. Adams*	27
346	——— (Zizyphinus) granulatus. *Born*	27
347	——— " armillatus. *Woods. Z. Meyeri, Philippi* (Br.)	27, 55
348	——— " fragrum. *Philippi*	27
349	——— " incertus. *Reeve*	27
350	——— (Monilea) *roseus. T.-Woods*	27
351	——— " *turbinatus.* "	27
352	——— (Minolia) *Tasmanicus.* "	27
353	——— (Infundibulum) fimbriata. *Swainson.* (*Carinidea.*) T.-Woods)	27

354	Trochus (Infundibulum) Tasmanica. (*Carinidea.*) (*Carinidea.* T.-Woods)	27
355	——— (Infundibulum) aurea. *Jonas.* (*Carinidea.* T.-Woods)	27
356	Trochus (Thalotia) conicus. *Gray.* *T. Picta,* T.-Woods (Br.) "	55, 27
357	——— " dolorosa. *T.-Woods*	55, 27
358	——— " tesselatus. "	31
359	——— " dubium. "	31
360	——— (Elenchus) badius. *Woods*	27
361	——— " bellulus. *Dunker*	27
362	——— " irisodontes. *Quoy*	27
363	——— " nitidulus. *Phil. Kust*	27
364	——— *Baudini*	44
365	——— (Cantharidus) pulcherrimus. *Gray*	55
366	——— " Lesueri. *Fischer.* (*T. picta,* T.-Woods)...	55
367*	——— (Bankivia) varians. *Bech.*	27
368	——— (Trochochlea) Australis. *Favanne*	27
369	——— " constrictus. *Lam.*	27
370	——— " tæmatum ? *Quoy and Gaim*	27
371	——— " compta. *T.-Woods*	27
372	——— (Euchelus) canaliculatus. *Lam.*	27
373	——— " Tasmanicus. *T.-Woods.* (*Fossarus Tasmanica*) T.-Woods.	27
374	——— " scabriculus. *Ad. and Angas*	27
375	——— (Clanculus) nodulosus. *A. Adams*	27
376	——— " Aloysii. *T.-Woods*	27
377	——— " Philomenæ. "	27
378	——— " Dominicanæ. "	27
379	——— " Raphæli. "	27
380	——— " Angeli. "	27
381	——— " conspersus. *A. Adams*	27
382	——— " rubens. "	27
383	——— " undatus. *Lam.*...	27
384	——— " Mangeri. *Adams*	27
385*	——— " variegatus. "	27
386	——— " gibbosus. "	27
387	——— " nodo-liratus " *Gibbula multicarinata, T.-Woods* (32)	27
388	(Astele) subcarinatus. *Swainson*	27

(xlvi.) Family STOMATELLIDÆ. (sp. 2.)

389	Stomatella imbricata. *Lam.*	27
390	Stomatia (Gena) strigosa. A. Adams	27

(xlvii.) Family PLEUROTOMARIIDÆ. (sp. 1.)

391	Schismope Atkinsoni. *T.-Woods.* (*Scissurella,* T.-Woods, 1876)	27

(xlviii.) Family HALIOTIDÆ. (sp. 4.)

392	Haliotis nævosa. *Martyn*	27
393	——— glabra. *Swainson*	27
394	——— carinata. *Martini*	27
395	——— elegans. *Koch*	27

(xlix.) Family FISSURELLIDÆ. (sp. 13.)

396	Fissurella Australis. *Krauss*	27
397	——— scutella. Gray	27
398	——— nigrita. *Sow.*	27
399	——— concatenata. *Crosse*	27
400	——— crucis. Beddome	49
401	——— (Machroschisma) Tasmanica. *T.-Woods.* (Var. a, *Rosea.*) (T.-Woods.)	27
402	Emarginula emarginata. *Blainville*	27
403	——— rugosa. (Quoy ?) *Sow.*	27
404	——— Tasmaniæ. *Sow.*	27
405	——— tenuicostata. "	27
406	Parmophorus elongatus. *Blainville.* (*Scutus* T.-Woods)	27
407	——— (Tugalia) Australis. *Sow.*	27
408	——— " Tasmanica. *T.-Woods*	27

(l.) Family PATELLIDÆ. (sp. 16.)

409	Acmæa septiformis. *Quoy*	27
410	——— marmorata. *T.-Woods*	27
411	——— crucis. "	27
412	——— costata. *Sow.*	27
413	——— cantharus. *Reeve*	27
414	——— flammea. *Quoy*	27
415	——— conoidea. "	27
416	——— Petterdi. *T.-Woods*	27
417	——— alba. "	27
418	Patella aculeata. *Reeve*	27
419	——— tramoserica. *Martyn*	27
420	——— decora. *Philippi*	27
421	——— ustulata. *Reeve*	27
422	——— Tasmanica. *T.-Woods*	27
423	——— Chapmani. "	27
424	——— radians. *Gmelin*	27

(li.) Family CHITONIDÆ. (sp. 11.)

425	Chiton (Lophyrus) Australis. (*R. Mag. Nat. Hist.* 1840)	27
426	——— (Lepidopleurus) liratus. *Ad. and Angas*	27
427	——— " speciosus. "	27
428	——— piceus. *Gmel.*	27
429	——— proteus. *Reeve*	27
430	——— *Sinclairi* ? Gray	27

431	Chiton glaucus. 〃	27
432	——— (Plaxifora) petholatus. *Sow.* *C. ciliata.* Sow ?	27
433	——— (Acanthochites) Zelandius. *Quoy.* Probably identical with *C. crinitas* Pennart, and *C. fasicularis*	27
434	Chitonellus (Cryptoplax) Gunni. *Reeve*	27
435	——— 〃 spinosa. *A. Adams*	27

OPISTHOBRANCHIATA.

(lii.) Family Philinidæ. (sp. 1.)

436	Philine aperta. *Linne*	27

(liii.) Family Tornatellidæ. (sp. 2.)

437	Tornatina Mariæ. *T.-Woods*	27
438	Ringicula Australis. *Crosse*	27

(liv.) Family Cylichnidæ. (sp. 2.)

439	Cylichna arachis. *Quoy and Sow.*	27
440	——— Atkinsoni. *T.-Woods*	27

(lv.) Family Bullidæ. (sp. 2.)

441	Bulla oblonga. *A. Adams*	27
442	Haminea obesa. *Sow.*	27

(lvi.) Family Lophocercidæ. (sp. 1.)

443	Akera Tasmanica. *Beddome*	49

(lvii.) Family Aplysiidæ. (sp. 2.)

444	Aplysia concava. *Sow.*	27
445	——— Tasmanica. *T.-Woods*	27

PULMONATA.

(lviii.) Family Vitrinidæ. (sp. 3.)

446	Vitrina Milligani. *Pfeiffer*	22, 34, 40
447	——— Verreauxi. 〃	22, 34, 40
448	——— fumosa. *T.-Woods*	34, 40

(lix.) Family HELICIDÆ. (sp. 73.)

449	Helix architectonica. *Brazier*		22, 35, 40
450	—— antialba. (*Beddome*		
451	—— Bassi. *Brazier*		
452	—— Barrenensis. *Petterd*		
453	—— bisulcata. (Pfr.)		
454	—— Bischoffensis. *Beddome*		
455	—— cellaria. *Mueller* *		
456	—— cæsus. *Cox*		
457	—— Collisi. *Brazier*		
458	—— Curaçoæ. "		
459	—— Diemenensis. *Cox*		
460	—— direlicta. "		
461	—— dispar. *Brazier*		
462	—— Du Cani. *Cox*		
463	—— Dyeri. *Petterd*		
464	—— Fordei. *Brazier*		
465	—— Furneauxensis. *Petterd*		
466	—— Gunni. *Brazier*		
467	—— Gadensis. *Beddome*		
468	—— Hamiltoni. *Cox*		
469	—— Hobarti. "		
470	—— Halli. "		
471	—— Henryana. *Petterd*		
472	—— Hookeriana. *R. M. Johnston*		
473	—— jungermanniæ. *Petterd*		
474	—— Kingi. *Brazier*		
475	—— Kershawi. *Petterd*		
476	—— lampra. (Pfr.)		
477	—— Launcestonensis. *Reeve*		
478	—— Legrandi. *Cox*		
479	—— lamproides. "		
480	—— Luckmani. *Brazier*		
481	—— limula. *Cox*		
482	—— Langleyana. *Brazier*		
483	—— Lottah. *Petterd*		
484	—— Morti. *Cox*		
485	—— mimosa. *Petterd*		
486	—— marchianæ. *Cox*		
487	—— M'Donaldi. "		
488	—— Mathinna. *Petterd*		
489	—— Nelsonensis. *Brazier*		
490	—— Officeri. *Cox*		
491	—— Otwayensis. *Petterd*		
492	—— parvissima. *Cox*		
493	—— positura. "		
494	—— plexus "		
495	—— Petterdi. *Brazier*		
496	—— pictilis. *Tate*		

* The three species so marked have been introduced from Europe, and are now abundant in Launceston and Hobart, in gardens or cellars.

497	Helix pulchella. *Mueller* *	
498	—— questiosa. *Cox*	
499	—— ruga "	
500	—— rotella. *Brazier*	
501	—— Roblini. *Petterd*	
502	—— Sinclairi. (Pfr.)	
503	—— subangulata. (Prf.)	
504	—— sitiens. *Cox*	
505	—— Stephensi. *Cox*	
506	—— subrugosa. *Brazier*	
507	—— Spiceri. *Petterd*	
508	—— Stanleyensis. "	
509	—— Savési. "	
510	—— Tasmaniæ. *Cox*	
511	—— tranquilla. "	
512	—— Trucanini. *Petterd*	
513	—— trajectura. *Cox*	
514	—— Tamarensis. *Petterd*	
515	—— vitrinaformis. *Cox*	
516	—— Wynyardensis. *Petterd*	
517	—— Weldii. *T.-Woods*	
517a	—— aspersa. " *	
518	—— Brunonia. *R. M. Johnston*	56
519	Bulimus Dufresni. *Leach*	22, 35, 40
520	——— Tasmanicus. *Pfeiffer*	22, 35, 40

(lx.) Family PUPIDÆ. (sp. 1.)

521	Pupa Lincolnensis. *Angas*	48

(lxi.) Family LIMACIDÆ. (sp. 1.)

522	Limax Legrandi. *Tate*	42

(lxii.) Family ARIONIDÆ. (sp. 1.)

523	Cystopelta Petterdi. *Tate*	42

(lxiii.) Family SUCCINEIDÆ. (sp. 4.)

524	Succinea Legrandi. *Cox*	22, 35, 40
525	——— Australis. *Pfeiffer*	22, 35, 40

(lxiv.) Family AURICULIDÆ. (sp. 4.)

526	Cassidula zonata. *H. and A. Adams. Auricula Dyerana,* T.-Woods, 27	32
527	Alexia Harrissoni. *Beddome*	49
528	Marinula pellucida. *Cooper*	27
529	Ophicardelus cornea. *Swainson. Auricula Australis.* Martyn	27

(lxv.) Family LIMNÆIDÆ. (sp. 27.)

530	Limnæa Sub-aquatilis. *Tate.* Var. a neglecta	57
531	——— Gunnii. *Petterd*	57
532	——— lutosa. "	57
533	——— stagnalis " (Introduced)	57
534	Amphipeplea Launcestonensis. *T.-Woods*	33, 57, 58
535	——— " ? (Var. *Papyracea*) Tate	57
536	Physa Van Diemenensis. Sow.	Possibly var. of *P. nitida* 28, 33, 45, 58
537	—— aperta "	
538	—— nitida. "	
539	—— *Huonensis.* *T.-Woods*	
540	—— Bruniensis. "	
541	—— Tasmanicola "	
542	—— Huonicola. "	
543	—— eburnea. *Sow.*	
544	—— *attenuata.* "	
545	—— mamillata. "	
546	—— *Tasmanica* ? *T.-Woods*	Possibly a var. of *P. nitida*
547	—— *Legrandi* ? *T.-Woods.* Possibly a var. of *P. nitida*	
548	Planorbis meridionalis. *Brazier*	*P. Tasmanicus.* T.-Woods 33, 58, 57
549	——— Atkinsoni. *R. M. Johnston*	
550	——— Scottiana. "	
551	——— *Australianus.* Martens. Probably identical with *P. meridionalis.*	
552	Ancylus Cumingianus. *Bourg.*	28, 33, 58
553	——— *Irvinæ* ? *Petterd.* Probably large variety of the variable *A. Cumingianus*	57, 58
554	——— Tasmanicus. *T.-Woods*	28, 33, 58
555	Gundlachia Petterdi. *R. M. Johnston*	33, 58
556	——— *Beddomei* ? *Petterd.* Probably a variety of *G. Petterdi*	57

(lxvi.) Family AMPHIBOLIDÆ. (sp. 3.)

557	Amphibola (Ampullarina) fragilis. *Quoy*	27
558	——— " Quoyana. *Desh.*	27
559	——— " minuta. *T.-Woods*	27

(lxvii.) Family SIPHONARIIDÆ. (sp. 3.)

560	Siphonaria Diemenensis. *Quoy*	27
561	——— denticulata. *Quoy and Gaim*	27
562	——— zonata. *T.-Woods*	27

CLASS SCAPHOPODA.

(lxviii.) Family DENTALIIDÆ. (sp. 2.)

563	Dentalium Tasmaniensis. T.-Woods	27
564	——— Weldiana. "	27

CLASS PELECYPODA.

(SINUPALLIATA.)

(lxix.) Family GASTROCHÆNIDÆ. (sp. 2.)

565	Aspergillum (Humphreya) Strangei	27
566	Gastrochæna Tasmanica. *T.-Woods*	27

(lxx.) Family TEREDIDÆ. (sp. 1.)

567	Teredo navalis. *Gray*	27

(lxxi.) Family PHOLADIDÆ. (sp. 1.)

568	Barnea Australasiæ. *Gray*	27

(lxxii.) Family SOLENIDÆ. (sp. 1.)

569	Solen vaginoides. *Lam.*	27

(lxxiii.) Family SAXICAVIDÆ. (sp. 2.)

570	Saxicava Australis. *Lam.*	27
571	Panopæa Australis. Sow	27

(lxxiv.) Family CORBULIDÆ. (sp. 3.)

572	Corbula *Zelandica ?* Quoy. (Doubtful.) T.-Woods	27
573	——— erythrodon. *Lam.* " "	27
574	Neræa Tasmanica. *T.-Woods*	27

(lxxv.) Family ANATINIDÆ. (sp. 11.)

575	Anatina anserifera. *Spengler*	27
576	——— creccina. *Valence*	27
577	——— Tasmanica. *Reeve*	27
578	——— Angasi. *Crosse*	27
579	Myodora brevis. *Stutchbury*	27
580	——— *ovata ? Reeve.* (Doubtful if identical with *Reeves'* species. (T.-Woods)	27
581	——— pandoriformis. *Stutchbury*	27
582	——— Tasmanica. *T.-Woods*	27
583	——— albida. "	27
584	Myochama anomioides. *Stutchbury*	27
585	——— (sp. indet)	27

(lxxvi.) Family MACTRIDÆ. (sp. 4.)

586	Mactra rufescens. *Lam.*	27
587	——— pura. *Deshayes*	27
588	——— cretacea. Angas	27
589	Lutraria dissimilis. *Deshayes*	27

(lxxvii.) Family Paphiidæ. (sp. 5.)

590	Paphia (Anapa) triquetrum. *Hanley*	27
591	——— " Tasmanica. *T.-Woods.* Possibly a variety of *P. triquetrum*	27
592	——— (Donacilla) elongata. *Deshayes*	27
593	——— (Mesodesma) erycina. *Lam.*	27
594	——— " precæsia. *Deshayes*	27
595	——— " Diemenensis. *Quoy and Gaim* ...	44

(lxxviii.) Family Semelidæ. (sp. 3.)

596	Semele decora. *A. Adams*...	27
597	——— exigua. *H. Adams*...	27
598	——— Warburtoni. *T.-Woods*	27

(lxxix.) Family Tellinidæ. (sp. 13.)

599	Tellina deltoidalis. *Lam.*	27
600	——— albinella. "	27
601	——— umbonella "	44
602	——— diemenensis. *Deshayes*	27
603	——— Tristis. "	27
604	——— (Arcopagia) decussata. *Lam.*	27
605	——— Mariæ. *T.-Woods*	27
606		
607	Gari compta. *Deshayes*	27
608	—— zonalis. *Lam.*	27
609	—— Atkinsoni. *Brazier*	27
610	Hiatula epidermia. *Deshayes*	27
611	——— vitrea. "	27

(lxxx.) Family Veneridæ. (Sp. 26.)

612	Venus (Chione) Humphreyi. *Donovan*	27
613	——— " conularis. *Lam.* } *V. Aphrodinoides*	27
614	——— " lamellata. " } *V. Scalarina* ...	27
615	——— " Stutchburyi. *Gray*	27
616	——— " roborata. *Hanley*	27
617	——— " gallinula. *Lam.*	27
618	——— " Macleayana. *T.-Woods*	27
619	——— " striatissima. *Sow.*	27
620	——— " Australis. "	27
621	——— " lævigata. "	27
622	——— " *fumigata* ? " Doubtful species ...	27
623	———	
624	Cytherea (Callista) Diemenensis. Hanley	27
625	——— " planatella. *Chemnitz* ?	27
626	——— " *candida* ? Deshayes. Unknown. (T.-Woods)	27
627	——— " disrupta. *Sow.*	27
628	——— " *citrina* ? *Lam.*...	27

629 Cytherea (Callista) *rutila ?* *Deshayes.* Doubtful. (T.-Woods) 27
630 ——— „ Victoriæ. *T.-Woods* 27
631 ——— (Gouldia.) Petterdi. „ 27
632 Dosinia grata. *Deshayes* 27
633 ——— *japonica ? Reeve.* Doubtful. (T.-Woods.) ... 27
634 ——— *coryne. A. Adams* 27
635 ——— crocea. *Deshayes* 27
636 ——— immaculata. *T.-Woods* 27
637 Tapes undulata. *Born.* Rare. 27

INTEGRIPALLIATA.

(lxxxi.) Family Cyrenidæ. (sp. 4.)

638 *Corbicula Brunnea ?* Prime. Doubtful 44
639 Pisidium Tasmanicum. *T.-Woods* 28
640 ——— Dulvertonensis. „ 28
641 Sphærium (Cyclas) Tasmanica. *T.-Woods* 28

(lxxxii.) Family Petricolidæ. (sp. 6.)

642 Rupellaria Diemenensis. *Quoy and Gaim* 27
643 ——— *brevis ?* „ Doubtful. 27
644 ——— reticulata. *T.-Woods* 27
645 ——— crenata. *Lam.* 27
646 ——— sub-decussata. *Deshayes* 27
647 ——— carditoides. *Lam.* 27

(lxxxiii.) Family Cardiidæ. (sp. 4.)

648 Cardium tenuicostatum. *Lam.* 27
649 ——— pulchellum. *Reeve* 27
650 ——— *papyraceum ? Chemnitz.* Probably var. of *C. tenuicostatum*... 27
651 ——— cygnorum. *Deshayes* 27

(lxxxiv.) Family Chamidæ. (sp. 1.)

652 Chama (sp. indet) 27

(lxxxv.) Family Lucinidæ. (sp. 4.)

653 Lucina (Cyclas) divaricata. *Linne* 27
654 ——— „ minima. *T.-Woods*... 27
655 ——— „ pecten. *Lam.* 27
656 Loripes icterica *Reeve* 27

(lxxxvi.) Family Ungulinidæ. (sp. 1.)

657 Mysia Tasmanica. T.-Woods. *Diplodonta.* T.-Woods 27

(lxxxvii.) Family Erycinidæ. (sp. 4.)

658	Lasæa (Poronia ? australis. *Sow*	27
659	——— " ? scalaris. *Phil.*	27
660	Kellia Atkinsoni. *T.-Woods*	27
661	——— (Pythina) Tasmanica, *T.-Woods*	27

(lxxxviii.) Family Crassatellidæ. (sp. 3.)

662	Crassatella Kingicola. *Lam.*	27
663	——— aurora. *Ad. and Angas*	27
664	——— Banksii. "	27

(lxxxix.) Family Astartidæ. (sp. 6.)

665	Cardita Raouli. *Angas*	27
666	——— Quoyi. *Deshayes*	27
667	——— Gunni. "	27
668	——— amabilis. "	27
669	Mytilicardia Tasmanica. *T.-Woods*	27
670	——— *excavata*. *Deshayes*	27

HOMOMYARIA.

(xc.) Family Unionidæ. (sp. 1.)

671	Unio *Moretonicus?* Reeve. Very variable in form, probably one of the many varieties of *U. Australis*	28, 59

(xci.) Family Trigoniidæ. (sp. 1.)

672	Tregonia Margaritacea. *Lam.*	27

(xcii.) Family Nuculidæ. (sp. 4.)

673	Nucula Grayi. *D'Orb.*	27
674	——— minuta. *T.-Woods*	27
675	Leda crassa. *Hinds*	27
676	——— Lefroyi. *Beddome*	49

(xciii.) Family Arcidæ. (sp. 9.)

677	Arca trapezia. *Desh.*	27
678	——— fasciata. *Reeve*	27
679	——— *semitorta*. *Lam.*	44
680	——— *pistachia* "	44
681	——— *squamosa* "	44
682	Pectunculus radians "	27
683	——— obliquus. *Reeve* ?	27
684	——— *flabellatus*. *T.-Woods*. *P. orbicularis* ... Angas ?	44
685	Limopsis Tenisoni. *T Woods.*	27

HETEROMYARIA.

(xciv.) Family MYTILIDÆ. (sp. 10.)

686	Mytilus latus. *Lam.*	27
687	——— *Tasmanicus.* *T.-Woods.* Doubtfully distinct from last	27
688	——— Dunkeri. *Reeve*	27
689	——— rostratus. *Dunker*	27
690	——— hirsutus. *Lam.*	27
691	——— crassus. *T.-Woods*	27
692	Modiola Australis. Gray. Doubtfully distinct from *M. tulipa.* (T.-W.)	27
693	——— albicostata. *Lam.*	27
694	——— arborescens. *Chemnitz*	27
695	Modiolaria Cumingiana. *Dunker*	27

(xcv.) Family AVICULIDÆ. (sp. 4.)

696	Avicula pulchella. *Reeve*	27
697	——— (Meleagrina) *alba.* *Lam.*	44
698	Crenatula *modiolaris.* *Lam.*	44
699	Vulsella Tasmanica. *Reeve...*	27

(xcvi.) Family PINNIDÆ. (sp. 1.)

700	Pinna Tasmanica. *T.-Woods*	27

MONOMYARIA.

(xcvii.) Family SPONDYLIDÆ. (sp. 1.)

701	Spondylus tenellus. *Reeve*	27

(xcviii.) Family PECTINIDÆ. (sp. 5.)

702	Pecten meridionalis. *Tate.* 54. *P. fumatus.* Linne. T.-Woods	27
703	——— asperrimus. *Lam.*	27
704	——— bifrons. 〃	27
705	——— Atkinos. *Petterd.* Allied to *P. asperrimus* ...	53
706	——— Mariæ. *T.-Woods*	27

(xcix.) Family LIMIDÆ. (sp. 2.)

707	Lima (Radula ?) lima. *Linne*	27
708	—— 〃 bullata. *Born*	27

(c.) Family ANOMIIDÆ. (sp. 1.)

709	Placunanomia *Zealandica ?* Gray. Doubtful. ...	27

ES, ORDEDERS.

SUB-CLAS

rnished with	*R effected by*	*Shell.*
y beaks... ...	Plums	Internal.
rmature... ...	Branmming discs ...	Internal, external, or absent.
"	Gillsr disc	Mostly univalve, spiral, or conical.
e tentacles ...	Bran "	Straight or curved tube.
y leaflets ...	Gillst atrophied ...	Bivalve hinged.
nents	Manoung ; fixed in	Bivalve with perforated beak.

SUB-ORD

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... ...	... ...	(Fam.	i.	——	ii.)
... ...	... ...	"	iii.	——	v.)
... ...	... ...	"	vi.		)
nell	... ...	"		——	)
... ...	... ...	"		——	)
... ...	... ...	"	vii.	——	xxxix.)
out anterior canal	... ...	"	xl.	——	l.)
" "	... ...	"	xl.	——	xlviii.)
" "	... ...	"	xlix.	——	l.)
3 separate pieces	... ...	"			li.)
vimming by means c	... ...	"	—	——	—)
the mantle ...	... ...	"	lii.	——	lvii.)
into cavities in mant	... ...	"	—	——	—)
nd the anus ...	... ...	"	—	——	—)
... ...	... ...	"	—	——	—)
uperior pair of ten	... ...	"	lviii.	——	lxiii.)
" "	... ...	"	lviii.	——	lxiii.)
" "	... ...	"	—	——	—)
ttened and triangul	... ...	"	lxiv.	——	lxviii.)
guments rugose	... ...	"			lxiv.)
" smooth	... ...	"			lxv.)
d brackish water ;	... ...	"	lxvi.	——	lxvii.)
be, not spiral ...	... ...	"		——	lxviii.)
s	... ...	"	lxix.	——	lxxxix.)
... ...	... ...	"	lxix.	——	lxxx.)
sinus	... ...	"	lxxxi.	——	lxxxix.)
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... ...	... ...	"	xc.	——	xciii.)
rior large ...	... ...	"	xciv.	——	xcvi.)
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s generally support	... ...	"			cii.)
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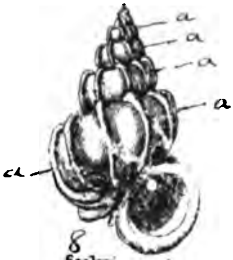
Ranella ele
Frog she

Phasianella australis
Pheasant



Scalaria pretiosa
Wentle trap

/

toides

(ci.) Family OSTREIDÆ. (sp. 4.)

710	Ostrea *edulis*? *Linne*	27
711	——— mordax. *Gould*	27
712	——— rutupina. *Jeff*	27
713	——— Angasi. *Sow.*	27

MOLLUSCOIDA.

CLASS BRACHIOPODA.

(cii.) Family TEREBRATULIDÆ. (sp. 3.)

714	Waldheimia flavescens. *Lam.*	27
715	Kraussia Lamarckiana. Davidson	27
716	——— Atkinsoni. *T.-Woods*	27

CORRIGENDA.

Page	7	FOR	Pelecypooa	READ	Pelecypoda.
"	38	"	Trochocochlea	"	Trochochlea.
"	48	"	Parnea	"	Barnea.
"	74	"	Arosalpinx	"	Urosalpinx.
"	76	"	Ancillari	"	Ancillaria.
"	"	"	Aesopus	"	Æsopus.
"	77	"	Cancellari	"	Cancellaria.
"	"	"	Cythara	"	Cithara.
"	78	"	Cassmaria	"	Casmaria.
"	79	"	Cirostrema	"	Cirsotrema.

DESCRIPTION OF A SECOND GANOID FISH FROM THE LOWER MESOZOIC SANDSTONES NEAR TINDER-BOX BAY.

By Messrs. R. M. Johnston and A. Morton.

On the 19th August, 1889, we had the pleasure of bringing under the notice of the members of this Society a new Ganoid Fish, from the Knocklofty sandstones, and named *Acrolepis Hamiltoni*, in honour of our worthy President, Sir Robert Hamilton. We have now the honour of giving a full description of a second species of the same genus recently discovered in a sandstone formation near Tinder-Box Bay, deemed to be nearly of the same geological horizon as the sandstones of Knocklofty.

Acrolepis Tasmanicus. *n. sp.* *Johnston and Morton.*

Body compressed, elongate, elliptical; length from snout to end of caudal fin, nearly 6 inches; length of head, 14 lines; length of body, 4½ inches; snout projecting beyond lower jaw; greatest depth, 14 lines; least depth at peduncle, 5 lines. Dorsal fin somewhat falcate, composed of 48 to 50 slender rays (6 to a line) each one of which branches into two or three sub-divisions near extremities, and each one or two rays crossed distantly and in a curved manner by fine oblique ridges; base, 8¾ lines long, occupying a position nearer the tail than the snout, anterior end being 37 lines distant from snout, and the posterior end 45¾ lines; greatest length of dorsal (2nd, 3rd and 4th longest) same as base, 8¾ lines; the longer anterior rays curve over the anterior ones, which abruptly diminish in size, the posterior margin being thus irregularly vertical. Anal fin about the same size and composed of nearly the same number of rays as the dorsal fin, but its position is nearer the tail, the anterior portion commencing about 40 lines from the snout, and the posterior terminating about 48¼ lines distant. Ventral fin composed of about 18 fine rays, central, and well in advance of anal fin. Pectoral, imperfect, somewhat elongate, and consisting of numerous fine rays, which become subdivided towards extremities as in the dorsal fin. Rays of sub-caudal fin numerous, fine; fin elongate, nearly equal in length to the slightly elevated caudal extremity,* and forming with it a bifurcation which is almost as symmetrical as the true homocercal forms; the rays on the lower margin of the true tail lobe form a narrow inconspicuous fringe. All the rays of caudal extremity are extremely fine, about 21 in the space of 12 lines, those of the sub-caudal fin are crossed repeatedly with curved, raised lines, composed of short, oblique ridges as in dorsal fin.

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* Length of caudal lobe (upper), 19 lines; length of sub-caudal fin, 14 lines; distance between extreme tips of caudal furcation, 15½ lines.

There are about 64 rows of small rhomboid scales or plates longitudinally arranged in an inclined and slightly curved dorso-ventral series. The transverse series varies considerably in number and depth; there being about 18 in oblique transverse series near peduncle, and about 35 near the shoulder; the scales are greatest in depth towards the lateral line, diminishing greatly as they approach dorsal and ventral margins; the base of each scale runs parallel nearly with others of the longitudinal series, and in a general view seem to divide the surface into fine parallel rows, which cut the more or less curved oblique transverse series into an oblique rhomboid pattern.

Each scale or plate is ornamented on the upper surface with the peculiar furcated raised linear ridges of the genus *Acrolepis*; these forked ridges seem to radiate from a point at the lower posterior angle and fork once or twice, upward and forward, in the direction of the anterior upper angle. This furcation reminds one of the forking neuration on the lobes of many species of ferns, and is very remarkable. Fortunately a portion of the fossil shows the under surface, and each scale of these series is characterised by a small tooth-like projection in the centre of each upper margin, with a corresponding raised socket on lower surface half the depth of scale, into which the tooth of each scale respectively of the lower series scale fits closely. Both socket and tooth have an angle corresponding to the direction of the transverse serial lines; the ornamentation of the scales forming the lateral line differs from all the others, as the fine furcate lines radiate more nearly from the centre of posterior margin, half of which curve upwards, and the other half downwards. As a rule the linear ridges are fewer in number relative to size of scale in the lateral line series.

This fine specimen was obtained from the Lower Mesozoic Sandstones near Tinder-Box Bay.* A group probably belonging nearly to the same geological horizon as the Knocklofty sandstones, Hobart, from which was obtained the remains of *Acrolepis Hamiltoni*, recently described by us in the Proc. of the Royal Soc. of Tas. (1889). The species here described is much better preserved, and though closely allied to the former it is very distinct. The chief differences are the greater prolongation of the sub-caudal fin, giving greater symmetry to the caudal fork; the greater number of scales or plates in the lateral and transverse series; and also the relatively greater development of the vertical fins.

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* In p. 149, "Johnston's Geology of Tasmania," these sandstones are described as "a series of reddish or yellow micaceous sandstones, sometimes of great thickness, often occur overlying the uppermost beds of the Upper Palæozoic Mudstones as at Tinder-Box Bay, Huon-road, and Waterworks Valley, near Hobart, with indistinct plant impression and silicified trunks of conifer. These sandstones apparently lie conformably and without stratigraphic break upon the uppermost beds of the Upper Marine series (Up. Pal.). Their position is assigned provisionally at the base of the Mesozoic rocks of Tasmania."—(*Johnston.*)

The ornamentation of the scales or plates, although of the same character, also appear to be much finer. The position and relative dimensions of fins also differ to some extent.

Good photographs have been taken of the two sections disclosed by the splitting of the rock in which the specimen was imbedded.

Along with these are given magnified views of the under and upper surface of the scales or plates, and also an enlarged view of the dorsal fin, showing the subdivided extremities of rays. The fine series of fulcral scales can be discerned forming a serration along the anterior margin of dorsal fin. There is a probability of a larger number of these interesting fish remains being obtained when operations in certain quarries are again carried out.

THE DISCOVERY AND OCCUPATION OF PORT DALRYMPLE.

BY JAMES BACKHOUSE WALKER.

1. THE DISCOVERY.

It is a fact, often forgotten, that an interval of a century and a half separated the discovery of the eastern coast of Australia from that of her western shores. The western coast was visited by the Dutch in the early part of the 17th century. It was not until the last half of the 18th that the eastern coast was first seen by European eyes. The discovery of Southern Tasmania belongs to the old period—to the days of the Dutch East India Company, and of Tasman's search for the Great South Land—to the days when New Holland had an evil reputation as the most forbidding and inhospitable country on the face of the earth. The discovery of our northern coast was one of the last of the modern epoch, when English navigators had laid open to the world the rich promise of the fertile lands of Eastern Australia, and when the first of the great English southern colonies had already been planted at Port Jackson.

A short sketch of the exploration of the Straits, and particularly Port Dalrymple, although it may traverse some ground already touched upon in former papers, may prove of interest as an introduction to the story of the settlement of Northern Tasmania. Such a sketch will serve to bring into due prominence the achievements of two men, whose names should be held in honour by every Tasmanian, as practically the discoverers of our island home and the pioneers who opened it for English colonisation. These two men were George Bass and Matthew Flinders.

I trust, therefore, that my readers will forgive my detaining them for a time from the settlement of Port Dalrymple by a prefatory history of the events which led to its discovery.

The existence of a great southern continent surrounding the antarctic pole and pushing itself northward far into the Pacific Ocean was a fixed belief of the old geographers. The hope of discovering such a continent prompted not only the voyage of Abel Tasman towards the unknown South Land in 1642, when he discovered the southern coast of Van Diemen's Land, but many another expedition of the old navigators. As is well known, Captain Cook's first voyage in the *Endeavour*, in 1768, was undertaken for the purpose of observing the transit of Venus from a station in the South Seas. But when the observations had been made, Cook, in accordance with his instructions, headed the *Endeavour* from Tahiti to the far south, to make one more effort to solve the old geographical problem. After reaching lat. 40° S. without seeing any sign of land, he turned north and then west until he sighted what he at first took for the long-sought Terra Australis Incognita. It is scarcely necessary to say that this was the east coast of New Zealand. After circumnavigating the islands, in March, 1770, the question arose as to the homeward route. Cook himself had a strong desire to return by Cape Horn in order finally to determine whether there was or was not a continent in that direction. As, however, winter was approaching, it was thought inadvisable to venture into the stormy seas of those high latitudes. It was resolved, therefore, to return by the East Indies, and with this view to sail westward until they should fall in with the undiscovered east coast of New Holland, and then follow that coast to its northern extremity. The *Endeavour* took her departure from Cape Farewell, and on 19th April, 1770, sighted land at Point Hicks, about 60 miles westward of Cape Howe. Cook had expected to see the coast of Tasman's Van Diemen's Land to the south, and from the sudden falling of the sea concluded that it was not far off, but was not able to determine whether it was joined to New Holland or not. From Point Hicks he sailed north, exploring the whole length of the eastern coast, which he named New South Wales, until he reached its northern extremity at Cape York, and returned home by Torres Straits.

Cook's First Voyage, ii., 282.

Ibid., ii., 433.

Ibid., ii., 483.

Two years later, Cook sailed on his second voyage in the *Resolution*. He was accompanied by the *Adventure*, commanded by Capt. Tobias Furneaux. The ships were separated in a fog in 50° S. lat., between the Cape and New Zealand, and Furneaux shaped his course for the land marked on the charts as Van Diemen's Land, which he sighted on 5th March, 1773. After a short stay he sailed out of Adventure Bay with the intention of exploring the east coast as far as Point Hicks, Cook's most southern point, in order to discover whether the coast of

Van Diemen's Land was joined to that of New Holland. The *Adventure* sailed northwards till land was lost sight of a little to the north of the Furneaux Group, but continuing a northerly course Furneaux saw, or fancied he saw, land again in about lat. 39°. Here the soundings indicated the presence of shoals, and thinking the navigation too dangerous, he stood away for New Zealand. His conclusion is thus expressed:—"It is my opinion that there is no strait between New Holland and Van Diemen's Land, but a very deep bay."

Cook's Second Voyage, i., 115.

No further exploration in that direction took place before the settlement of Port Jackson in 1788, and for years subsequently the resources of the new colony were too limited to allow of more than boat expeditions to short distances from the Sydney Heads.

In June 1797, however, the wreck of a vessel named the *Sydney Cove*, on Cape Barren Island in the Furneaux Group, led to the despatch of the colonial schooner *Francis* to the scene of the wreck. The trips of the *Francis* not only extended geographical knowledge, but aroused a keen interest in the locality, as the seat of a most lucrative seal fishery.

Flinders' Voyage, Intro. 104.
Hunter to Portland, 6 July, 1797.

Just at this time H. M. S. *Reliance* arrived at Port Jackson from the Cape of Good Hope, with a cargo of cattle. She was in a very leaky condition, and had to be detained for extensive repairs. Amongst her officers were two eager and adventurous spirits, her Second Lieut., Matthew Flinders and her Surgeon, George Bass. They were both young—Flinders was 23—both ardent and full of zeal for exploration. On a previous voyage of the *Reliance* they had made a daring expedition down the coast in a boat only 8 feet long, and Bass had travelled inland to try to cross the Blue Mountains. On this occasion Flinders could not leave his ship, but Bass, tired of inaction, prevailed on Governor Hunter to lend him a whaleboat for a more extended voyage. The Governor gave him a boat, six weeks' provisions, and a crew of six seamen from the King's ships. In this whaleboat Bass made his way down the coast, examining the inlets and harbours, and battling with head winds and gales, for a distance of more than 600 miles. Rounding Cape Howe, and passing Cook's furthest point (Cape Hicks), he sighted the high land afterwards known as Wilson's Promontory, but the contrary winds preventing him from reaching it, he stood across for the Furneaux Islands, where he hoped to replenish his stock of provisions. The wind, however, now drove him to the south-west, and as

26 June, 1797, Collins' New South Wales, ii., 318.
Flinders' Voyage, Intro., 106.

the gale and sea increased, the water rushed in fast through the boat's side, and he was obliged to go on the other tack. After a time of considerable danger he once more reached the Promontory, this time on the west side, and proceeding along the coast, discovered and entered Western Port. He was detained in the Port for a fortnight by contrary gales, and as the seventh week of absence from Port Jackson had expired, want of provisions forced him very reluctantly to turn the boat's head homeward. On his way back he examined Wilson's Promontory, and came to the conclusion from various indications that there must be a strait between Van Diemen's Land and the mainland. He found that the flood tide swept westward past the Promontory at the rate of two or three miles an hour, the ebb setting to the eastward. "Whenever it shall be decided," he says in his journal, "that the opening between this and Van Diemen's Land is a *strait*, this rapidity of tide, and the long south-west swell that seems to be continually rolling in upon the coast to the westward, will then be accounted for." Strong contrary gales delayed Bass on his homeward voyage, and it was not until after an absence of 12 weeks, during a great part of which he and his crew had subsisted chiefly on mutton-birds, that he returned to Port Jackson, and reported his discoveries to Governor Hunter. Flinders' Voyage, Intro., 117.

1 March, 1798. The Governor, in his despatch to the Duke of Portland, says that Bass "found an open ocean westward, and, by the mountainous sea which rolled from that quarter, and no land discoverable in that direction, we have much reason to conclude that there is an open strait through, between the latitude of 39° and 40° 12′ S., a circumstance which, from many observations made upon tides and currents, I had long conjectured . . . I presume it will appear that the land called Van Diemen's, and generally supposed to be the southern promontory of this colony, is a group of islands separated from its southern coast by a strait, which it is probable may not be of narrow limits, but may perhaps be divided into two or more channels by the islands near that on which the *Sydney Cove* was wrecked."

Flinders' Voyage, Intro., 120. During Bass' absence in the whaleboat the *Francis* was again sent to the wreck, and this time Flinders accompanied her. The schooner went as far south as the entrance of Banks' Strait, and Flinders got his first sight of the north coast of Van Diemen's Land. The smoke rising from the land showed that there were inhabitants *Ibid.*, 120.

on it, and as there were none on the adjoining islands, Flinders was shaken in his belief in the existence of a strait, for he could not understand how, unless by a connecting isthmus, men could have reached the more distant Van Diemen's Land and yet failed to have attained the intervening islands, more especially as those islands were so abundantly supplied with birds and other food.

When Flinders met Bass in Sydney and heard of his observations at Wilson's Promontory, he declared that there wanted no other proof of the existence of a strait than that of sailing positively through it; and this the two friends now anxiously waited for an opportunity to do. Their professional duties, however, delayed the execution of the project, but six months later when the *Reliance* returned from her voyage to Norfolk Island, Flinders explained his views to Governor Hunter, and the Governor gave him the *Norfolk*, a sloop of 25 tons, with a crew of eight volunteers, to attempt the circumnavigation of Van Diemen's Land. This voyage was briefly mentioned in a former paper, and it is not now necessary to follow it in detail, except so far as concerns our immediate subject, the discovery of Port Dalrymple. On the 7th October 1798, Flinders and Bass sailed in their tiny vessel on their now famous voyage. Their first point was Cape Barren Island, and thence they sailed through Banks' Strait and proceeded along the north coast of Tasmania. On the 3rd November, at two o'clock in the afternoon, Flinders saw with great interest indications of an opening in the land, and bore up for it. The vessel advanced rapidly with the flood tide, and, rounding a low head, entered a broad inlet. Sailing up this inlet some three miles, they passed a low green island, when suddenly the sloop grounded. Fortunately the ground was soft, the strong flood dragged the sloop over into deep water, and drove her rapidly onward till the harbour suddenly expanded into a broad and beautiful basin, on which swam numbers of black swans, duck, and wild fowl. Its shores were broken into points and projections, covered with wood and grass down to the water's edge,—a strong contrast to the rocky and sterile banks observed in sailing up Port Jackson. There appeared to be three arms or rivers discharging themselves into this extensive basin, and, as evening was coming on, the sloop was anchored near to the mouth of the western arm. Flinders was greatly pleased with his discovery, to which Governor Hunter gave the name of

Flinders' Voyage, Intro., 138.

Ibid., 152.

Port Dalrymple, in compliment to Alexander Dalrymple, the well known Hydrographer to the Admiralty. He employed 16 days in examining the place, explored Western and Middle Arms, worked his way up Whirlpool Reach, and got as far as Shoal Point and Crescent Shore, when, although he believed that half the river was still unexplored, the limited time allowed him compelled his return. The *Norfolk* took her departure from Low Head, and, sailing along the north coast, rounded Cape Grim, her commander finally settling the problem of the insularity of Van Diemen's Land by his circumnavigation.

The importance of the discovery was at once recognised in England; and early in 1800 the *Lady Nelson*, a brig of 60 tons, was fitted out and despatched under Lieut. Grant to examine the new strait. It was, however, left to Flinders himself in the *Investigator* two years later, to complete his own work by making the first reliable survey of its northern shores.

As we have already seen, the discovery of Bass Strait, and the possible colour it might give to French claims to the island, were among the causes which prompted King's hasty occupation of the Derwent by Bowen in 1803; and it was owing to King's urgent representations of the importance of forming settlements in the Straits to assist the seal fisheries and anticipate the French that Governor Collins' expedition was despatched to Port Phillip. When Governor Collins found his position at Port Phillip untenable, he was doubtful whether he should not remove his people to Port Dalrymple rather than to the Derwent. Governor King was also, in the first instance, strongly in favour of the northern locality, considering it more advantageously situated for the principal settlement in Van Diemen's Land, chiefly on account of the protection it would afford to English sealers in the Straits from the attacks of American interlopers. His only doubt was whether the soil was as good as that on the Derwent, and whether the entrance to the port was not too dangerous. To enable Governor Collins to satisfy himself on these points, he sent the schooner *Francis* to Port Phillip to serve as a surveying vessel. She was in a very leaky condition, and though they tried to patch her up at Port Phillip, and sent her, with William Collins, Clark, the agricultural superintendent, and Humphreys, the mineralogist, to make an examination of Port Dalrymple, she proved so unseaworthy that William Collins had to send her back to

King's Despatch, 21 May, 1802.

King to Collins, 26 Nov., 1803,

King to Woodriffe, 26 Nov., 1803.

Collins to King, 27 Jan., 1804.

Sydney and complete his voyage in the *Lady Nelson*, which he fell in with at Kent's Group.

The *Lady Nelson* entered Port Dalrymple on New Year's Day 1804. William Collins immediately proceeded with his examination. The *Lady Nelson* anchored above Upper Island (now Pig Island), and from thence the examination of the yet unvisited portion of the river was made in a boat. William Collins was delighted with the appearance of the country about the present site of Launceston, diversified with hill and plain, with good land both for pasture and agriculture. He went some distance up the Main River (North Esk) and found excellent land. Then he entered the Cataract Gorge. Grand as its towering rocks are now, the Gorge in its natural state, when clothed with the wild beauty of its native bush, and full of wild fowl, must have been magnificent. William Collins says of it: "The beauty of the scene is probably not surpassed in the world. The great waterfall or cataract is most likely one of the greatest sources of this beautiful river, every part of which abounds with swans, ducks, and other kinds of wild fowl. On the whole I think the River Dalrymple possesses a number of local advantages requisite for a settlement."

Collins' Report, January, 1804.
Clark's Report.

Collins had been 18 days in Port Dalrymple, and was anxious to get back to the Lieutenant-Governor with his good news. A fair wind carried the *Lady Nelson* across the Straits in two days, and on the 21st January Lieutenant Symons brought his ship to an anchor off the Camp, inside Port Phillip Heads. The Camp was a scene of busy activity, and when Wm. Collins landed to present his report, he found that the Lieutenant-Governor had at last made up his hesitating mind, and that the establishment was on the point of sailing to the Derwent. It so happened that Governor King had heard such a bad account from the captain of a schooner which had touched at Port Dalrymple for water, who painted such a picture of the dangers of the entrance and the hostile attitude of the blacks, that he had written advising Collins to give up all idea of the northern port. The Lieutenant-Governor, therefore, had the satisfaction before sailing of having his superior officer's approval of his final choice.

Collins to King, 28 Feb., 1804.

King to Collins, 30 Dec., 1803.

The reports of the explorers had now lost their immediate interest, and the Lieutenant-Governor forwarded them to King with the despatch announcing his departure.

Collins to King, 27 Jan., 1804.

2.—THE OCCUPATION OF THE TAMAR.

Possibly Governor King, if left to himself, would have been contented, at least for the time, with the establishment of the Colony at the Derwent as a sufficient safeguard against French designs. But the apprehensions of the Home Government had been thoroughly aroused by the Governor's despatches pressing the urgent necessity of occupying certain points in Bass Straits and Van Diemen's Land to prevent the probable intrusion of French claims to the territory. It was the consideration of these despatches which had led to the writing of the Minute of December, 1802, quoted in a former paper, and to the sending of Governor Collins to Port Phillip with instructions to place a post on King's Island also. The Cabinet, however, was not yet satisfied with the precautions taken, and six months later Lord Hobart addressed a despatch* (24th June, 1803, p. 429) to Governor King, in the following terms:— 24 June, 1803.

"It appears to be advisable that a part of the establishment now at Norfolk Island should be removed, together with a proportion of the settlers and convicts, to Port Dalrymple, the advantageous position of which, upon the *southern* coast of Van Diemen's Land, and near the *eastern* entrance of Bass' Streights, renders it, in a political view, peculiarly necessary that a settlement should be formed there, and as far as the reports of those who have visited that coast can be depended upon, it is strongly recommended by the nature of the soil and the goodness of the climate."

The despatch proceeded to designate Lieutenant-Colonel Wm. Paterson of the New South Wales Corps, Lieutenant-Governor under Governor King, as the Administrator of the new Colony, at a salary of £250 a year.

Lord Hobart's despatch was very perplexing to King. The direction to occupy Port Dalrymple was too positive to be disregarded, and yet the grotesquely inaccurate description of Port Dalrymple as on the *southern*† coast of Van Diemen's Land, and near the *eastern* entrance of Bass Straits, introduced an element of uncertainty that threw him into a difficulty as to his course of action. It was probable that Lord Hobart's directions were the result of a despatch of his own, dated 23rd November 1802, in which he had strongly urged a settlement at Storm Bay Passage, Port Phillip, or King's Island, to counteract any intention of the French intruding a claim within the limits of his government. But if so, it might be "respectfully presumed" that a mistake had been made in naming Port Dalrymple as on the south coast of Van Diemen's Land, and then the inference was that Storm Bay Passage was really intended. If this construction were right, then Colonel Collins's removal to the Derwent had anticipated the Minister's wishes. Furthermore, as Lord Hobart when writing had supposed Port Phillip to be already occupied by Collins, would his commands be best fulfilled by settling Port Dalrymple or re-settling Port Phillip? Or, if the despatch were literally obeyed, and Port Dalrymple occupied, would it not be advisable to send also a small post to Port Phillip or Western Port?

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* As an instance of the roundabout way in which even important Government Despatches reached the Colony in those days, it may be mentioned that Lord Hobart's despatch was landed at Norfolk Island by the *Adornis* whaler, and brought thence to Port Jackson by the *Alexander* whaler.

† It does not seem to have struck King that "southern" was probably merely a clerical error for "northern." In fact, this is the only possible explanation.

The Governor propounded these questions to his principal officers, Lieutenant-Governor Colonel Paterson and Major Johnston of the New South Wales Corps, for their consideration and advice. They were unanimously of opinion that the commands of the Secretary of State to occupy Port Dalrymple, "with a political view," were too explicit and peremptory to admit of hesitation, and that they must be immediately carried into effect. They thought that the north side of the Straits should also be occupied, and a post established either at Port Phillip or Western Port, whichever might be found the more eligible situation. They recommended that Colonel Paterson should forthwith be despatched to Port Dalrymple with a small establishment, and a guard of not less than 20 soldiers.

Opinion of Officers, 18 May, 1804.

King to Hobart, 15 May, 1804.

Having thus settled his course of action, the Governor lost no time in taking steps to send a force to occupy the post pending the transference of the colonists from Norfolk Island. The armed colonial cutter *Integrity*, 56 tons, was at once fitted for sea, and a small private vessel of 25 tons, called the *Contest*, was chartered to assist. The two ships were to take 20 convicts and a force of 34 soldiers, in all 56 persons. On the morning of the 7th June the New South Wales Corps was drawn up on the Government wharf as a guard of honor, and Lieutenant-Governor Paterson embarked in the pinnace to go on board his vessel. The pinnace left the

King to Hobart, 14 Aug., 1804.

Sydney Gazette, 10 June, 1804.

wharf, the battery fired a salute, and, to quote the reporter of the *Sydney Gazette*, "the most animated acclamations issued from the shore" as the new Lieutenant-Governor set out to found another British Colony—or rather to attempt to found it—for the same fate which befell the first attempt to found the Derwent Settlement attended that to the Tamar. It was now the depth of winter, and storms such as had driven back Lieutenant Bowen on his attempt to reach the Derwent just 12 months before met the ships at the entrance to Bass Straits. The *Integrity*, on rounding Cape Howe, battled in vain against the strong westerly winds which prevailed in the Straits, and had to put back to Port Jackson, which she reached on 21st June,* her passengers all ill in consequence of being battened down in the hold. The *Contest*, after beating about for a month, had to follow her consort's example. King was much disappointed, and made offers to the masters of two East India Company's ships then in harbour to take Paterson and his people to their destination, offers which their charter parties prevented them from accepting. There was therefore no alternative but to delay the expedition until the approach of spring, when H.M.S. *Buffalo* would be available for the service required.

King to Hobart, 14 Aug. 1804.

Paterson to King, 27 Sept., 1804.

During the interval between the return of the *Integrity* and the departure of the *Buffalo* a question of some difficulty arose respecting Paterson's relations to the Lieut.-Governor at the Derwent. Colonel Collins claimed that his appointment as Lieut.-Governor extended to the whole of Van Diemen's Land, that the northern settlement was therefore within his jurisdiction, and Paterson under his command. This claim Paterson wholly repudiated. He contended that he had received an appointment from the King as Lieut.-Governor of Port Dalrymple at a time when Collins was supposed to be at Port Phillip, that consequently his command was *wholly* independent of Collins, and he absolutely refused to tolerate any interference by the Lieut.-Governor at the Derwent with him or his settlement. Governor King admitted the cogency of Paterson's argument, and issued a General Order dividing the island into two independent governments, to be known respectively as the Counties of Buckingham and Cornwall, the dividing line to be the 42nd parallel of south latitude, each government to be

23 Sept., 1804.

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* Paterson in his despatch to Lord Camden, 14th November 1805, says he arrived in Port Jackson 17th June 1804, but this is probably an error.

subordinate only to himself as Governor-in-Chief of New South Wales and its dependencies.

Instructions to Paterson, 1 June, 1804.

Governor King's instructions to the new Lieut.-Governor present curious matter for study. We may pass over the usual directions as to the treatment of the aborigines, the investigation of the products of the country, the care of clothing, stores, and live stock, the oversight of the convicts, the regulations for the occupation of lands and their cultivation, religious worship, and so forth. But there are other features in the instructions which present a very striking contrast to what would in these days be thought proper to inculcate on the founder of a new colony. It must never be forgotten that these early establishments were not colonies at all in the modern sense, but military posts, established for political purposes, in which a limited number of convicts were utilised to provide the labour necessary for their maintenance. Instead, therefore, of encouraging trade and settlement, every possible precaution was taken to ensure the most complete isolation. This had the double object of keeping out foreign intruders and guarding against the escape of the convicts. Paterson was expressly enjoined to take particular care that all communication with the East India Company's possessions, with China, or with the islands visited by any European nation should be rigorously interdicted, or only allowed on the special authorisation of the Indian Government. No craft of any sort was to be built by any private person without a written licence from the Governor in Sydney. No intercourse was to be permitted between persons arriving in any vessel and the inhabitants of the settlement without the Lieut.-Governor's special permission. The American sealers who had given so much trouble to King had been building vessels from the wrecks of the *Sydney Cove* and other ships. These, if met with, were to be seized by putting the King's mark upon them. The introduction and sale of spirits by private persons was prohibited, and any which were introduced were to be seized and destroyed.

General order, 22 Sept., 1804. *Sydney Gazette*, 14 & 30 Sept., 1804.

By the end of September H.M.S. *Buffalo* was fitted and ready for sea. The armed tender *Lady Nelson* and the Colonial schooners *Francis* and *Integrity* were to accompany her, and assist in conveying the people and stores to the new colony. Paterson's establishment consisted of Dr. Jacob Mountgarrett (who had come up with Lt. Bowen in the *Ocean* on 24 Aug., and on leaving Risdon had received the appointment of Surgeon);

King to Hobart, 20 Dec., 1804.

King to Paterson, 11 Aug., 1804. King to Hobart, 20 Dec., 1804.

Mr. Alexr. Riley, Storekeeper, at a salary of 5*s*. per day; Capt. Anthony Fenn Kemp, Ensigns Hugh Piper and Anderson, 64 non-commissioned officers and privates of the N. S. Wales Corps, and 74 convicts. One settler, James Hill, accompanied the party, and possibly another. In all there were some 146 persons all told. The troops were embarked on Wednesday, 3rd October,—the music of the band, says our reporter of the *Sydney Gazette*, being "only interrupted by reiterated peals of acclamation from the spectators." On Sunday, October 14th, the Lieut.-Governor embarked from the Government wharf, under a salute of 11 guns from the battery, the band of the N. S. Wales Corps playing "God save the King" and "Rule Britannia." Governor King and a number of ladies and officers accompanied him on board the *Buffalo*, which saluted with 11 guns. The little squadron got clear of the Heads the next forenoon. The ships had a very rough voyage down, and a succession of heavy gales separated them. Most of the live stock died; and it was not until the 28th—a fortnight after leaving Port Jackson—that the *Buffalo* reached Eastern Cove, Kent's Group, where she found the *Francis*. Here she lay at anchor for 6 days, while it blew a strong gale from the westward. On the 3rd November the ships left their anchorage, and next morning the *Buffalo* made the entrance of Port Dalrymple. None of her consorts were in sight to try the channel for the larger vessel; and Captain Kent, with many misgivings, determined to make the venture; for he says, in his report to Governor King, "I saw little probability of the Settlement ever being formed unless some risk was run. I therefore bore up, in dark cloudy weather, blowing strong at north-west right on shore, for a harbour little—very little—known, hoping, should any accident happen to the ship, I might meet with every consideration for my zeal." After what he had heard of the strength of the tides, he was surprised to find it running only 1¼ miles per hour, and avers "that a common four-oared jolly-boat, rowed ill, could always, even in the height of the springs, head the tide between Green Island and Outer Cove, as it never exceeded 3 miles an hour." The night coming on, the ship came to an anchor below Green Island. It blew very hard in the night, and harder in the morning, the anchor came home and the ship drove on shore on the eastern shoals. Here she lay beating for three days; but the *Integrity*, Acting Lieut. Robbins, coming in, they lightened the ship of

Sydney Gazette.

Kent's Report, 28 Nov., 1804.

part of her cargo; and on the 4th day, after great exertions, she was got off, fortunately without damage, and came to an anchor in Outer Cove (George Town). Here the military, prisoners, and stores were landed, the tents were pitched, and on the 11th November possession was formally taken by hoisting H.M. Colours under a royal salute from the *Buffalo* and three volleys from the troops.

Paterson to Camden, 14 Nov., 1805.

Paterson to King, 23 Nov., 1804.

The other two ships did not arrive till the 21st, the *Lady Nelson* having suffered much damage from the storm, having had her decks swept, and having lost all her live stock. Before leaving, Captain Kent erected a flagstaff at Low Head, and other beacons for the guidance of vessels entering the port.

The day after taking possession (12th November), the camp was approached by a body of some 80 natives, under the lead of a chief. Presents were offered to the chief—a looking-glass, two handkerchiefs, and a tomahawk. Paterson says that the looking-glass puzzled them much, and that, like monkeys, on looking at it they put their hands behind it to feel if there was any one there. When they came to the boat they wanted to carry off everything they saw, but when made to understand that this could not be allowed they retired peaceably. Shortly afterwards, however, the blacks returned in greater force and made an attack on an outpost. A correspondent of the *Sydney Gazette* thus describes the incident:—"An interview took place with the natives, which began very amicably, but, unfortunately, their natural impetuosity has caused a temporary suspension of civilities, having attempted to throw a sergeant from a rock into the sea, and attacked his guard of two men, which compelled them to fire in their own defence." One black was killed, and another wounded in this affray.

Ibid.

16 Dec., 1804.

The hurried landing at Outer Cove was necessitated by the accident to the *Buffalo*, and the pressing need of immediately unloading her. As there was a sufficient stream of water for present use, and about 100 acres of land that might do for cultivation, Paterson thought it best to keep his people at the spot where they had landed until he should have had time to explore the river. Captain Kemp, Dr. Mountgarrett, and Mr. Reilly, the storekeeper, were appointed the first magistrates of the settlement, Dr. Mountgarrett acting as Superintendent of Public Works. Mr. Thos. Massey was made chief constable, with three subordinates; two overseers were appointed, and Jas. Hill, the solitary settler, was

Paterson to King, 26 Nov., 1804.

General order, 19 Nov. 1804.

put in charge of the live stock. His duties were not onerous, for only a horse, four head of cattle, three sheep, and 15 swine had survived the storms of the passage. There was no chaplain, and as Paterson was at a loss for a person to perform Divine service, he induced Captain Kent to discharge from the *Buffalo* a Mr. Edward Main, who, we may presume, had some qualifications for the office, and who was thereupon installed to attend to the spiritual wants of the little community. The prisoners were set to work to erect temporary huts for themselves, which were placed clear of the camp on the opposite side of the creek, to prevent as far as possible communication with the troops. The prisoners worked hard and cheerfully from daylight to dark every day, and in a fortnight from the time of landing the huts were completed.

Paterson to King, 26 Nov., 1804.

The Governor's next care was to begin cultivation, for, with a salt meat diet, a plentiful supply of vegetables was most important to the health of his people. A gang of men was therefore set to work to break up ground. The means at hand for cultivation were limited; hardly any agricultural implements had been provided. The seeds had nearly all been destroyed by rats on the passage down, and most of the plants sent had died, though a few fruit trees and strawberry and hop plants had been saved. The Governor had to buy potatoes for seed from the master of the *Integrity*, as the authorities had not thought it worth while to send any for the use of the colony. Paterson's despatches show that in fitting out the expedition there had been the same extraordinary want of care and foresight in providing necessary things which seems to have been characteristic of official preparations for all these early settlements. He complains to Governor King that the prisoners were wholly destitute of shoes, and that he had been compelled to ask the purser of the *Buffalo* to let him have 100 pairs from the vessel's stock; while in such a vital matter as the supply of provisions, the quantity sent was so inadequate, in view of the difficulty and uncertainty of obtaining timely aid from head quarters, that he had thought it necessary to supplement his stock with salt meat from the *Buffalo's* stores.

Ibid.

The Lieut.-Governor had already made some short excursions from Outer Cove, and Captain Kent, of the *Buffalo*, had examined Western Arm, where he had found good streams of water, land fit for cultivation, and good timber; and from his report Paterson thought that it appeared to be the most eligible situation for the seat of government. It had taken him three weeks to get his people fairly settled at Outer Cove, and he was now free to go up the river and thoroughly examine the country. On the 28th November, therefore, he went on board the *Lady Nelson*. He took with him Surgeon Mountgarrett; with Ensign Piper, and a corporal and 3 privates of the N. S. Wales Corps, as a guard. They ascended the river, making observations of the country and soil as they went, till they arrived at the junction of the two rivers forming the present port of Launceston; and here the vessel came to anchor. Paterson was greatly pleased with the park-like country on the present site of Launceston, and considered it better pasture land than the Seven Hills, near Parramatta. The party now proceeded up the main river (now North Esk) in the ship's boat and the Governor's wherry. The journal notes the rich plains on the river banks; and further on (near St. Leonard's) the beautiful rising ground to the left, the green hills covered to the top with trees, and on the other side of the river—which was about 20 yards wide—the plain with stately gums, great wattles 60 to 80 feet high, and dense scrub. They pushed on with difficulty, the river being blocked with drift-wood and fallen trees, and various rapids giving them much trouble, until they reached a point—apparently about the White Hills—above which they found it impossible to take the boat. Here they pitched their tent on a rising ground, and looked with delight over the rich plains, or rather meadows, covered with luxuriant herbs and pasture, and waiting for the plough. Paterson says, "From my tent there is an extent which is seen in one view of nearly three miles in length and at places one in breadth, along the banks of the river, where thousands of acres may be ploughed without falling a tree. These plains extend upwards of 10 miles along the winding banks, and everywhere equally fertile." He found good clay for bricks, abundant timber for building, reeds for thatching, with everything necessary for agricultural settlement, and considered the country superior to any yet discovered. They made excursions on foot some miles further up the river; and then, "having ascertained to a certainty that the country in general can hardly be equalled either for agricultural or pasture land," they made their way back down the river, and reached the *Lady Nelson* near the Cataract, after an absence of four days. Paterson describes the Cataract Gorge, with its stupendous

Paterson's Journal, 506.

Ibid., 515.

columns of basalt rising one above another to over 500 feet in height, as picturesque beyond description,—the effect being heightened by the number of black swans, unable to fly, in the smooth water close to the fall. Paterson named the Cataract River the South Esk; and, to the main river, including what is now known as the North Esk, he gave the name of the Tamar, out of compliment to Governor King, whose birthplace was on the English stream of that name. After an absence of a fortnight, the *Lady Nelson* got back to Western Arm, and entered that shallow inlet. Here Paterson landed to examine, for the second time, a piece of land at the head of the Arm, between two streams a quarter of a mile apart, and which he had named Kent's Burn and M'Millan's Burn. He says, "On landing, the soil is very forbidding, being a hard whitish clay mixed with quartz; but towards the hills there are patches of excellent ground, and the finest timber I ever saw (gum and wattle). Boats, at high water, can come up close to either of the runs. After much labour and attention I have paid in examining every part of the river, I have seen none so advantageously situated for a permanent settlement as this, where there is an easy communication with vessels arriving in this port as well as with settlements higher up the river. These favourable circumstances have induced me to determine upon removing the principal part of my small military force, with most of the prisoners, and commence clearing ground and erecting the necessary buildings before the winter sets in."

Paterson's Journal, 525.

The question naturally arises, by what extraordinary perversity of reasoning did Paterson arrive at the conclusion that the miserable patch of land at the head of Western Arm was pre-eminently the best place for his chief settlement? He had just come back from a visit to the splendid site of Launceston and the fertile banks of the North Esk, which he described as superior to any country yet discovered either in Van Diemen's Land or New South Wales, and as possessing every possible advantage for a settlement, including approach to it by a fine river navigable for large ships. What induced him, then, after anxious thought, to pass this by, and deliberately make choice of a narrow strip of land which he describes as having a forbidding soil, and which was situated at the head of a shallow and muddy inlet not accessible even to boats except at high water? The explanation, I think, is to be found in the policy of the home government. Founding a colony, according to modern ideas, means to open up the country as speedily as possible, to settle the lands with energetic cultivators who will develop the natural resources of the soil, to attract a population who will thrive themselves and advance the colony by the extension of an export trade. Nothing was further from the thoughts of the home authorities than any plan for colonising in this sense. New Holland was to be, not a colony, but a place for the reception of criminals,—a settlement to relieve the home country of the ever growing and overwhelming difficulty of disposing of her criminal population. The British Government not only did not encourage colonisation, they endeavoured as far as possible to prevent it, or at least to confine it within the narrowest limits, permitting it only in so far as it might be made to serve as an auxiliary to their sole object—the maintenance of a penal settlement at the smallest possible cost. The subordinate establishments at Port Phillip, the Derwent, Port Dalrymple, Newcastle, and other places were planted in the first instance as military posts, to prevent France establishing herself in spots where she might be able to harrass the great penal establishment at Port Jackson. The expeditions of Bowen, of Collins, and of Paterson were mainly precautionary measures, part of the military policy of England in her great struggle with France. Prisoners were a useful part of these early establishments, as providing labour which, by the erecting of buildings and cultivation of the soil, might make these posts as little burdensome as possible to the national exchequer. These outlying settlements, also, if favourably situated, might in course of time become valuable penal stations. Some of them, such as the Derwent and Port Dalrymple, would further serve the useful purpose of ports of refuge for the East India Company's vessels in the China trade, and form convenient posts for the protection of the whale and seal fisheries from American and other foreign intruders.

Bowen's choice of Risdon, and Collins' abandonment of Port Phillip when he could not find a suitable locality near the Heads, were not, as is too often supposed, the result of incapacity and blindness. They wanted to form a station, not to plant a colony—a station readily accessible from the sea—and the resources of the interior of the country were of little concern to them, so long as they could find in their immediate neighbourhood sufficient pasture for their cattle, and enough agricultural land to yield a food supply for their people. It was, doubtless, considerations such as these which led Paterson deliberately to turn away from the fertile banks of the North Esk and fix his people on the little strip of forbidding soil at the head of Western Arm.

Paterson to King, 27 Dec., 1804.

The Lieut.-Governor gave the name of York Town to the spot he had chosen for his town. He marked out the ground for erecting dwellings, and set the prisoners to work to load the *Lady Nelson* and *Francis* with a portion of the stores and with two wooden houses which he had brought with him from Port Jackson. He detained the *Lady Nelson* until after the new year in order to assist in the removal from Outer Cove, and when she sailed for Port Jackson on the 11th January, 1805, she took some tons of the iron ore which he had found in great abundance in the neighbourhood of his settlement.

Sydney Gazette.

From this point it is difficult to trace the history of York Town from the official papers. Paterson's despatches present a great contrast to the careful and voluminous reports sent by Governor Collins from the Derwent. Collins could give interest even to an official document, and introduced into his despatches an amount of graphic detail which not only gives us a full history of events but enables us to reconstruct the actual condition of his colony. Paterson was neither so precise nor so picturesque as Collins; his official communications are meagre, and his carelessness in supplying regular and full returns brought upon him the censure of Governor Bligh. The Lieut.-Governor's deficiencies can, however, be partly supplied from the columns of the *Sydney Gazette*, which, during the year 1805, contained many letters giving information with regard to the new settlement at Port Dalrymple.

Sydney Gazette, 10 Mar., 1805.

In January or early in February, 1805, the schooner *Integrity* was despatched by Governor King to examine a port situated to the westward of the mouth of the Tamar—presumably Port Sorell—which had been discovered by Surgeon Mountgarrett and Ensign Piper, and by them named Supply River. On the 22nd she left, carrying a report that the country between the Supply River and York Town had been found so good that it was intended to give the first free settlers locations of land in that district. The buildings at York Town were rapidly approaching completion. The colony at Outer Cove was doing well, the gardens had flourished, and on the 18th January—ten weeks after the first landing—the Governor and others who had cultivated small plots of ground had peas, French beans, potatoes, and turnips. Vegetables were plentiful, and it was fully expected that the cultivation of grain would be an equal success. Towards the end of March, H.M.S. *Buffalo* again sailed for the Tamar, carrying an additional military force, 50 prisoners—mostly from Norfolk Island—2 horses, 8 head of cattle, 135 sheep, and a quantity of stores. This made the total strength about 200 persons. Mrs. Paterson was a passenger by the *Buffalo*, and the transference of head-quarters to York Town was completed before the end of March.

Sydney Gazette, 24 Mar., 1805.

Paterson to King, 5 April, 1805.

By this time Paterson had received a welcome addition to his resources. Lord Hobart had, in 1803, directed Governor King to enter into an arrangement with Campbell & Co. of Sydney, to import cattle from India for the use of Collins's Port Phillip settlement. When Collins removed to the Derwent, King arranged with Campbell & Co. to supply these cattle to one or other of the Van Diemen's Land settlements. The directions as to their final destination were given in a way sufficiently curious, and which illustrates the primitive methods in use in those early days. The master of the vessel bringing the stock, on his arrival at the entrance of Bass Strait, was to send a boat ashore at Sea Elephant Bay, King's Island, where he would find a shed, from the rafters of which a bottle would be suspended, and in the bottle he would find a letter with the Governor's directions as to the port at which the cattle were to be landed. The contract price was to be £25 per head for the cows landed, and £5 per head for the calves. 910 cows were put on board the ship *Sydney* at Calcutta. Of these 298 died on the passage; the remaining 612, with 10 calves, being safely landed at Port Dalrymple at the end of March. The cost to the Imperial Government of this shipment was £15,350.

Campbell to King, 19 May, 1804.

King to Camden, 30 April, 1805.

As York Town did not afford sufficient pasture for the stock, the Lieutenant-Governor had them landed at Outer Cove, where Ensign Piper was placed in charge of them. The change of climate and food, however, was so injurious to them that their numbers rapidly diminished, and they were removed to the less exposed western shore, where sheds were erected for their shelter. In spite of all care and the labour of a large number of men in providing them with fodder, the winter reduced them so much that the return of spring saw only 251 of the Bengal cows surviving. Paterson therefore had them removed, first to Point Rapid and then to the

Paterson to King, 14 Nov., 1805.

Ibid., 30 Dec., 1805.

plains on the North Esk, where they found better pasture and a more congenial climate. Although York Town was now the head quarters, Paterson still kept up an establishment at Outer Cove as his port and his depôt for stock. He also had a small post at the Low Head flagstaff and at Green Island, which formed his store depôt. This did not meet with the approval of the Governor at Sydney, who objected to the division of his forces, and thought they ought to be concentrated at his principal settlement.

Paterson's Journal, 528.

There is little more to tell respecting the York Town Settlement. After a few months' trial Paterson found the site so unsuitable that in March 1806, he moved his head-quarters to the banks of the North Esk—the present site of Launceston. A small establishment was, however, maintained in the old port for upwards of a year longer, and then York Town was finally abandoned.

For long years afterwards the whole district was deserted, save for a few scattered and insignificant holdings. Towards the year 1870 (I think) attention was directed to the working of the rich iron deposits in the neighbourhood of Western Arm, and large smelting works were erected at Ilfracombe. The enterprise proved a failure.

Though the iron industry had failed, gold was destined to restore the fortunes of the district. Gold was discovered in 1870 at Cabbage-tree Hill, in the vicinity of Middle Arm, and by the development of the Tasmania Mine a considerable population has been attracted, so that in the present year we have the town of Beaconsfield a prosperous mining centre, claiming to be the third town in the Colony, within less than five miles of the spot which Lieutenant-Governor Paterson designed to make the capital of northern Tasmania.

Anyone who has the curiosity to see the ruins of this early settlement may easily reach the spot from Beaconsfield. A rough bush-track, practicable for a chaise cart, winds in a north-westerly direction through miserably poor country, covered with gum forest and a heath-like scrub intermingled with the dwarf grass-tree. After travelling for about 5 miles along this track and crossing the Anderson's Creek of Paterson, we reach M'Millan's Burn, now known as Massey's Creek, and emerge from the bush. Between this creek and a creek on the north, (called by Paterson Kent's Burn, but now known as the York Town Rivulet), just at the head of the Western

Arm, is a cleared flat of indifferent land, 300 to 400 yards wide. This is the site of Paterson's settlement. On the banks of the northern creek are some fair grass paddocks; and immediately beyond rises an abrupt, almost precipitous, wooded ridge, to which Paterson gave the name of Mount Albany. From the side of this hill the flat on which York Town stood lies spread out below us. Two little wooden cottages or huts, surrounded by neglected orchards, are the only habitations. To the left stretch the shallow waters of Western Arm, fringed with extensive mud-flats which are bare at low water. The owner of one of the huts on the desolate clearing is an old man, the son of a man who came with Paterson's first establishment. He is ready to tell the visitor of blacks and bushrangers, and of the days when there was a Government House, and York Town was busy with soldiers and prisoners.

Ruins of the original Settlement there are none. The old inhabitant points to a hole, from which the foundations have been long ago removed, as the site of Government House, and to a clump of wattles as the spot where once stood Captain Kemp's house, the birthplace of the late Mr. George A. Kemp. This is all;—except that back in the bush, where the little valley widens, are a few mounds under the gum-trees, half hidden by the low scrub, and indicating neglected and forgotten graves.

REMARKS ON A RECENT PROPOSAL TO INTRODUCE OSTRICHES INTO TASMANIA.

BY JAS. ANDREW.

During last year a proposal was made to the Government to introduce Ostriches into Tasmania, following the example of what was done with some little success in the Continental Colonies of Australia and in New Zealand at a time when very large profits were made out of this industry in the Cape Colony and other South African States. The offer, however, was made subject to the financial safeguard of a Government guarantee, and failed to secure favourable consideration.

From observations of the habits of wild ostriches, and from some little experience of their management when domesticated, having owned birds myself, I venture to offer a few remarks on farming for feathers, and the possibility of such an industry being successfully carried out in Tasmania.

An observer of ostriches in their native state would imagine the task of bringing such birds under the subjection of man to be almost an impossibility. No wild creature of the plains is so difficult to approach, none are so timid or so fleet. The stratagems of natives or the well organised arrangements of professional hunters are required to ensure a successful chase. And yet their domestication has been comparatively easy, and now that their habits are well understood it is found that in confinement they can be bred and reared, and maintained as adult birds, with no appreciable loss of their natural characteristics.

Their chosen home is a waterless desert, with sparse and stunted vegetation, affording no shelter from the burning sun; their food small reptiles and animals, the young leaves and twigs of bushes, and the wiry grass and other small plants whose existence under such surroundings is always a mystery to travellers. The speed of the ostrich is a marvel of pace. Each stride, as has been verified by careful measurements, is from 22ft. to 28ft. One observer reports 30 strides of 12ft. each in ten seconds, or 26 miles per hour, which agrees with the estimate formed by Dr. Livingstone.

The male bird is an imposing creature, in height to the top of the head often 9ft. and even sometimes 10ft., thus exceeding any other existing species of aves. The neck is long and muscular, the head small, with a broad and depressed bill, eyes large and brilliant. The wings are hardly more than rudimentary, being useless for purposes of flight, the thighs are exceedingly well developed, and are destitute of feathers, the legs and feet massive, the toes, two only in number, of unequal length. The body feathers in the male are deep black, the wing flights and tail feathers are, in strong contrast, pure white. The plumage of the female is a uniform brownish grey, but specimens are not infrequently met with having white wing and tail plumes, and I have seen domesticated birds of both sexes with spangled black or brown and white body feathers.

A peculiarity of an ostrich feather is that the quill is exactly in the centre of the webs instead of, as in the plumage of all other birds, more on one side than the other. This is accepted as the origin of their use as an emblem of justice in Egyptian hieroglyphics.

It appears that the geographical distribution of the ostrich was formerly much greater than at the present time, although even now its range is more extended than is generally supposed, including some parts of Asia, Arabia, and Northern and Southern Africa.

In a condition of nature ostriches are polygamous, and their nests, mere shallow depressions in the soil, are resorted to by several members of the same family, and in consequence the eggs they contain, laid at very varying intervals, are to be found at all stages of incubation. Contrary to a generally accepted belief the sun's rays are not depended upon to hatch out the chicks, the birds of both sexes taking turns of duty on the eggs. The hen bird lays every other day until some twenty or more are in the nest. The period of incubation is 42 days. The eggs are from 5 inches to 6 inches long, and 4 to 5 inches broad, weighing between 3 and 4 lbs., or of about 24 times the capacity of those of the common fowl; they vary in appearance in different countries, some being pitted all over with small dark coloured spots, others are a smooth creamy white, without blemish of any description, and resemble polished ivory. As an article of diet they are often of the greatest service, a large one, according to one writer, is said to furnish a meal for ten men. Hunters cook them in the shells placed on the embers of the camp fire, a hole knocked in the upper end, and the contents briskly beaten up with a forked stick during the operation. In puddings and custards they are frequently used by Ostrich farmers, and in this condition, as well as in the more primitive form, I have frequently had occasion to commend them as a welcome change in a very limited bill of fare. The shells, about 1/16th in. thick, are almost indispensable to the Bushmen of the Kalahari desert, for, filled with water, stores of them are buried for use on their return journeys from hunting expeditions or marauding forays, whilst pursuing parties, being unable to carry a sufficient supply, are unable to continue the chase.

Threaded on stout wire by which goods are suspended from the beams of store-houses, empty shells are an efficient precaution against injury by rats.

Prior to 1864, when modern experimental domestication commenced, the high prices ruling for feathers led to the indiscriminate slaughter of ostriches. In easily accessible districts they were soon exterminated, and there was occasion to fear that these interesting and valuable birds would soon become as extinct as their near connection, the Moa of New Zealand, and the enormous Æpyornis of Madagascar. But man's ingenuity and perseverance have counteracted the evil effects of his previous greed and destructiveness, and there is now no danger of so deplorable an event.

The author of the "Dominion of Man" shows that the settlers of South Africa are not the first Ostrich farmers, for in this, as in other instances, we find that the ancient Egyptians have been our predecessors. He states:—"On the monuments there are representations of ostriches which are under the dominion of man, and which are being handled in a manner which shows a thorough acquaintance with the character of the bird."

Rather less than thirty years ago the first attempt was made in the Cape Colony to keep ostriches in confinement with a view to profit. The feasibility of rearing their chickens artificially was soon demonstrated; the value of the new industry required no advertising; imitators of the original experimenters were numerous, and in a few years Ostrich farming was a firmly established resource of the Cape pastoralists. It was not necessary, however, to be a large landholder to commence operations, for breeding birds are always kept separate from the flock, each pair being enclosed in a camp or paddock of convenient size, varying in extent from five to forty acres, and chosen in a level locality, free from rocks, stumps, and holes. With rare exceptions domesticated birds are monogamous, but some difficulty often arises in inducing them to mate according to the desire of their owners. The hens are sometimes most capricious in their choice, whilst the males display absolute brutality towards unappreciated companions, and many changes are occasionally found necessary before satisfactory arrangements can be concluded. The breeding camps are enclosed by stone walls, thorn brush, or more frequently wire fences; and where a number of enclosures are together, the dividing fences must be double, with a space between of not less than 6ft. or 7ft., to prevent the male birds from fighting. A very slight enclosure suffices to confine ostriches at ordinary times, for they cannot step over a fence a yard high, but when frightened or enraged they rush blindly at any obstacle, and in consequence all enclosures must be secure.

During the nesting season the male is most pugnacious and may only be approached in safety with great precaution. He resents the intrusion of any visitors on his domain and proves a most formidable opponent. His mode of attack is by a series of kicks. The leg is thrown forwards and outwards until the foot, armed with a most formidable nail, is high in the air, it is then brought down with terrific force, serious enough to the unhappy human being or animal struck with the flat of the foot but much worse if caught and ripped by the toe. Instances are known of men being killed outright by a single kick, and I remember, whilst on a visit in the neighbourhood, that on a farm near Graaff Reinet a horse's back was broken by one such blow aimed at its rider. If attacked a man should never seek safety in flight; a few yards and the bird is within striking distance and the worst consequences may result. The alternative is to lie flat on the ground and submit with as much resignation as possible to the inevitable and severe pummelling which it may be expected will be repeated at intervals until a means of escape presents itself, or the bird affords an opportunity of being caught by the neck, which if tightly held and kept down prevents much further mischief. Under such circumstances, however, I have known a bird with a badly calculated kick strike the back of its own head scattering the brains, a serious loss of valuable property to the farmer. It is, of course, an easy matter to break a bird's neck when in the position described, but at the time to which I refer the high price of birds prohibited such a mode of relief except under the most exceptionally dangerous circumstances. The early practice amongst farmers was to enter the camps protected with a long pole forked at the end. As the bird advanced his neck was received in the fork and his feet kept beyond striking distance; but as they soon learned to suddenly back out of the prongs and before a fresh defence could be arranged to rush the intruder, it has been the custom more recently to carry a small thorn bush at the end of a long staff, which, always kept at the level of the bird's eyes, proves a tolerably efficient protection. It is usual for two men to enter a camp together when any work has to be performed, one to act as guard.

Confined in such small enclosures ostriches require, of course, some artificial food; this generally consists of mealies, or Indian corn, and often the leaves of the prickly pear chopped into pieces. They are also furnished with a supply of pounded bones. It is usual to keep drinking water in the camps, but as to whether this is necessary opinions differ. Birds have been deprived of water for nine months, whilst those in an adjoining enclosure had an unlimited quantity, but there was no apparent difference in their condition or health.

As a first step towards domestic duty the male bird, in confinement, scratches out a shallow depression in the ground, generally in some such unsuitable spot as the dry bed of an occasional water-course. The eggs vary to some extent in number, and on farms where natural nesting is preferred all over about twenty are removed.

There has been much difference of opinion as to the rival merits of leaving this process of hatching to the birds or saving them the duty by the use of incubators, but I am inclined to support the view that a larger percentage of chickens and stronger birds are secured by the former method. It is essential, however, that an incubator should be amongst the appliances of every ostrich farm for use in emergencies.

As in the wild state, the male performs an equal share of incubation with the female, who, being less conspicuous than her consort, remains on the eggs for the greater part of the day, the male sitting during the night, his turn of duty lasting from about four p.m. until early the next morning. At the proper hour the male grazes in the direction of the nest in an apparently indifferent manner until the hen, suddenly rising, runs some distance at a rapid pace, frequently changing her direction. At once he is on the eggs, and almost concealed, she having momentarily attracted the attention of onlookers. Much care is exercised by ostriches to conceal their nests, and it is surprising how inconspicuous the birds are when, surrounded by the low bushes of the veldt, they crouch over the eggs with their long necks extended on the ground.

It is not uncommon for one of the birds to refuse further duty at any stage of the hatching process, when the other, either male or female, may remain faithful to its instincts and, unaided, patiently complete the necessary period. The vitality of the embryo chick is remarkable. In my own experience I have in the early morning taken home eggs which had been exposed all night to a severe frost, and afterwards succeeded in hatching them in a box before the fire.

During natural incubation the eggs are liable to destruction by the many enemies of the ostrich, as are also the young birds for some time after hatching. Jackalls, baboons, hawks, and crows attack either eggs or chicks, whilst should an adult bird resent the appearance of a porcupine in its camp, it may be lamed for life by kicking against so efficiently armed an animal. It is no fiction that crows, unable to break and feast on the eggs by other means, pick up stones with their feet, and hovering perpendicularly over the nests, drop their missiles with destructive effect. They destroy tortoises in a somewhat similar manner: the reptile is itself raised into the air—a rock the target. What truth there may be in the assertion that a crow so encumbered cannot fly horizontally, I am unable to say, but there can be no reason to doubt the many authorities who vouch for the above.

The young birds are at first about the size of domestic fowls, but in their markings resemble young partridges, with the peculiarity of having what appear like small porcupine quills mixed with the down on their bodies. If hatched naturally they must be removed from the camps within ten or fourteen days or they are liable to acquire wild habits prejudicial to discipline in their future artificial state of existence. For the first month or two the chicksare exceedingly susceptible to changes of temperature, they are carefully watched by day by the boy in charge (any male native of whatever age is a "boy") and they soon learn to know and respond to his warning cry. They are easily frightened, and at any alarm scatter in all directions, and after running a short distance, crouch, neck extended, on the ground, and so resemble their surroundings that an inexperienced eye might easily fail to detect them even if right in their midst. Dogs, from their liability to cause a panic amongst youngsters and annoyance to older birds, should never be seen on an ostrich farm. At night the chickens are housed in warm flannel-lined boxes placed in an artificially heated room. For a day or two after first seeing light they require little or no food, but make preparation for the serious business of life by taking in a supply of small pebbles to assist the digestive action of the gizzard. Their first sustenance consists almost exclusively of soft green stuff chopped into pieces of convenient size. Lucerne, rape, cabbages, etc., are the usual diet, with later, a liberal supplies of mealies (Indian corn), or they may be successfully reared on veldt which has been kept clear from other stock. At all times, however, young ostriches must be kept away from the plants of wild tobacco, which, if eaten, invariably prove fatal to them. The birds grow rapidly and in a month are as large as turkeys, and the down has disappeared, being replaced with rudimentary feathers. At six months old they require comparatively little attention, the head of the bird will now be as high as an ordinary man, and in a year nearly the full size is attained and the first crop of feathers is fully ready for cutting. A most amusing peculiarity of young birds is a tendency when let out from the kraal in the morning to dance wildly and rapidly in a circle, neck extended and wings opened, at first revolving slowly, afterwards with increasing pace until they gyrate in a most astonishing manner. Although adults in size at this age it is not for another two years or more that their reproductive instinct appears to be developed.

Feather cutting is presumably the most important operation on a farm. The process is by no means cruel, and entails far more discomfort to the men employed than to the birds themselves. A small yard or enclosure is so closely packed with ostriches that they are quite unable to move and their only means of defence, by kicking, is prevented. A man can then go amongst them with impunity, and spreading in turn the wings of each bird with a small pair of self-opening garden nippers, he severs the quills of two or three feathers at a time, passing the plumes as cut to his assistant. The first row of the wing flights of the male bird, about 24 in number, are pure white, as also are the second and sometimes the third rows, but those with grey or brown edges are remarkably handsome, and all, even the small body feathers, are marketable. After being some time in the yards the birds becoming used to their surroundings peck persistently at any shining object, and frequently at the ears of the operators: all studs, bright metal buttons, etc., should be removed before commencing such work. One peck is a trifling circumstance, but many repetitions of it on the same spot occasion considerable pain: sore ears for some time afterwards has invariably been my experience after a day in the yards. In addition to this the birds swarm with vermin, which does not enhance the pleasure of the work. Sometimes it may be found impossible to get a male bird of savage disposition into the clipping pen, and then, and then only, is the practice of pulling the feathers resorted to, for he must be caught and held whenever a favourable opportunity presents itself. He may perhaps expose his neck to be seized and held fast over a fence, a second man can now approach from behind and pluck the feathers, returning to a place of safety with as much expedition as possible.

Most of the profit made in the earlier days of ostrich breeding was by the sale of young birds for stocking other farms. The prices realised were astonishing, and well paired mature birds could hardly be purchased except at prohibitory rates. In 1881 chickens, as soon as hatched, sold for £5 a-piece; at three months old, for £10; and at 12 months, for £20 or £30. At one sale thirteen lots of mated birds, some of which had commenced laying, realised from £125 to £220 per pair. These were from six to eighteen years of age. One exceptionally prolific pair were considered by their owner to have been worth quite £400 a year to him for several years in succession; for they reared four broods of chickens in thirteen months, all of which found a ready market at £10 per head. Feathers, of course, vary in value exceedingly, according to quality, and are subject to great fluctuations in price. In the halcyon days of this description of farming the best blood feathers, of which about 120 weigh 1lb., were worth from £40 to £60 per lb., or more than their weight in gold, and a domesticated adult bird yielded each year a crop worth nearly £20.

A peculiar blemish is often observed in ostrich feathers procured from tame birds, which is known as the "hunger streak." It appears, according to the authors of "Ostriches and Ostrich farming," as a line of imperfection across the web of each feather, chiefly in those of the wings, while on the shaft the mark may not only be seen but felt as a slightly projecting ridge. The injury from this cause is sometimes such as to occasion the feathers to break off." "It occurs most frequently in time of drought, when the birds are unable to procure their natural diet, and have to be fed on maize, or such other dry food as is most easily obtainable. This produces an unhealthy condition of skin, and experience has shown that the remedy lies in the cultivation of prickly confrey, which not only withstands droughts well, but furnishes the birds with excellent food well suited to their requirements.

Feathers require no preparation for sale except washing and careful classification. Of the different grades sorted for the London market those from wild birds rank first, then white tame feathers, the best only worth half as much as prime specimens of the former, followed by others known as feminas, byoks, boos, blacks, etc.

To preserve wild feathers from risk of injury, hunters and traders, during their rough and prolonged journeys in the interior of South Africa, used at one time to insert each valuable plume into a hollow reed. The end of the quill was first introduced, and by repeated tapping the whole feather gradually disappeared, the webs lying upright alongside the shaft. With the ends of such reeds securely sealed no harm could result.

There were only 80 tame ostriches in the Cape Colony in 1865, and the feathers exported weighed 17,522lbs., valued at £65,736, the whole of which, except 120lbs., were from wild birds. In 1875 the number domesticated was no less than 32,247, and the exports were valued at £304,933 for 49,969lbs. In 1882 exports reached the highest value they have ever yet attained, viz.: £1,093,989 for 253,954lbs., and since 1886, when the export was 288,568, valued only at £546,230, the yield has steadily decreased. The number of domesticated ostriches in the colony is now about 160,000. In twenty years the average price for all South African exports of feathers has fluctuated from 70s. to 110s. per lb.

It is evident, then, that the supply has exceeded the demand, the enormous profits made by the sale of young birds will never more be realised, and it is hardly to be expected that feathers will ever again be quoted at the old market rates. But there should still be substantial recompense to be earned in the country where they are indigenous by an ostrich farmer managing his property with skill and intelligence, and in spite of a certain amount of risk attached to the industry, it should be equally as attractive as sheep farming. The danger of allowing the free removal of birds and eggs to other countries was long ago recognised by the Government of the Cape Colony, for, in 1883, they imposed an export duty of £100 on every bird, and £5 on each egg. Before this, however, several shipments of ostriches had been forwarded to India, California, the River Plate district, and to the Australian Colonies, and it has been made evident that feather farming may be followed with some amount of success in all these countries. In fact any land with a dry and temperate climate, having level wastes, may be found suitable for this industry.

Tasmania, however, is less adapted for the purpose than any of the neighbouring continental colonies, or than parts of New Zealand. Wooded, hilly or uneven country is quite unfitted for farming ostriches and grassy plains are found to furnish an insufficient variety in diet. Climate has also to be taken into consideration and even in the dry Wimmera district of Victoria rheumatism and cold have proved very destructive amongst the birds kept there.

Further, the statistics of Australasia offer little encouragement to introduce ostriches here. In South Australia, where they have been kept for many years, the total number of birds is, at the present time, only 725. In Victoria, where it is nearly 20 years since Sir Samuel Wilson carried out experiments at Longernong the increase is insignificant, and in New South Wales and New Zealand there are only small flocks.

But more cogent reasons still for deprecating their acclimatisation in Tasmania are to be found in the existing state of the industry in South Africa, where full-grown birds can now be purchased for from £3 to £4 each, or about the value of their feathers at the current rates. Strayed birds, barely worth the trouble and expense of recovery, become in certain districts a cause of much annoyance and even danger to persons travelling, so that it is considered unsafe to go out except when armed with a gun, and the state of affairs has been found sufficiently important to warrant the appointment of a select committee of the House of Assembly in the Cape Colony, who in their report dated 4th July, 1889, recommended the repeal of the Acts of 1870 and 1875, which imposed severe penalties for interference with wild birds or their eggs, and advocated perfect freedom for their destruction on private property and liberty to anyone to shoot them on Crown Land on payment of £5 for a license.

NOTES ON A RECENT DREDGING TRIP IN THE DERWENT.

BY A. MORTON, F.L.S.

The Tasmanian Fisheries Commissioners having decided to examine the several bays in the river Derwent, for the purpose of ascertaining whether, as in former times, there still existed natural oyster beds, advantage was taken of the opportunity to pay special attention to the marine fauna that might be obtained by the means of the dredge. Mr. A. Durrand, F.R.M.A., a gentlemen on a visit to Tasmania, who has made a collection of Foraminifera from many parts of the southern seas, accompanied us on our trip.

Several bays to the northward of the harbour were tried, but the dredge failed to secure any specimens of oysters, and in only one or two instances did we obtain any dead shells. Although from a commercial point of view the result of the dredging trip proved comparatively a failure, still from a scientific point we were amply rewarded. Instead of finding the Oyster, a large quantity of Pectens or Scallops were obtained. *Pecten meridonalis*, *P. bifrons*, *and P. asperrimus*. As has already been pointed out by Mr. Seager, the Secretary to the Fisheries Commission, a large number of this shell fish can be obtained in the river Derwent by means of the dredge, the quality being equal to the European Scallops, it is to be hoped that steps will be taken by our fishermen to place in the market this class of shell fish that should readily find consumers. As the places we dredged in were rather far up the river, the number of species of Mollusca were naturally limited, those obtained belonging to the genus Cardium, Fusus, Triton, Elenchus, and a few others well-known. A large number of a pretty shell known as *Modiolaria Cumingiana*, Dunker, were met with, inhabiting the sponge, and embedded in the larger kind of Ascidians. This shell is common in the Australian waters and also in New Caledonia. Several Crustaceans, chiefly of the smaller kind, were obtained, one kind being found in great numbers inhabiting the common Mussel. This peculiar little Crab, belonging to the genus *Pinnotheridæ Pinnotheres pisium*, Leach, I find has a very wide range common in the European seas, and although found inhabiting the Mussel of New Zealand, has not yet, I am informed by Mr. Thos. Whitelegge, the able Zoologist of the Australian Museum, Sydney, been observed in the Mussel found round the New South Wales coast.

Professor Hutton, Professor of Biology of the Christchurch University, New Zealand, on receiving two or three examples of this Crab writes as follows :—

"The male *Pinnotheres pisium* does not live in the bivalve, but wanders about; consequently he is rare, and only got by chance. I do not think the Crabs hurt the Mussels." I am, however, of opinion that occasionally the male Crab is found frequenting the bivalve, as among some 30 or 40 specimens obtained by me in the Derwent, three or four were most certainly males. Since receiving Professor Hutton's letter I find, on referring to Mr. Thos. Bell's able work, entitled "A History of the British Stalk-Eyed Crustacea," the following remarks respecting this particular Crab:—"The species of this genus are very remarkable from the peculiarity of their being indebted to animals of a very different class for protection, although not truly parasitic. They are found always to inhabit the shells of the Bivalve Mollusca, pincipally of the Genera Mytilus, Modiolus, and Pinna, and occasionally also of the Ostrea, Cardium, and other Genera. The males are always very much smaller than the females." Bell's remark as to the scarcity of males agrees with what came under my notice during the recent dredging trip. He further states:—"This species, *P. pisium*, is very commonly found in the common Mussel, *Mytilus Edulis*, on many parts of our coast, and especially in those which are found in rather deep water. On one occasion I dredged great numbers of these Mollusca on the coast of Dorset, and found by far the greater number of them with one or two of these little soft bodied Crabs within their shells; for the females are much more common than the males. The latter sex I have occasionally taken apart from the Mussel shells, the former never."

A large number of species of a delicate Echini were met with, *Echinocardium Australe*, Gray, described by Gray in 1851. This species is found to have a very wide range, having been obtained in the N.E. and North Coast of Australia, Japan, S.E. Coasts of New Guinea, East Indies, Cape of Good Hope, New Zealand, and New Caledonia. The first specimens obtained in Tasmania were collected by Mr. Ronald Gunn in 1850, and referred to by Gray in the "Annals and Magazines of Natural History," 2nd series, vol. vii., 1851. Two species of *Holothuroidea* were obtained, one species, *Cucumaria*, having five rows of ambulacral feet, the other species, probably a *Psolus*, having only three rows of tube feet on a kind of foot, like that of some Mollusca. I forwarded some specimens of Cucumaria and Psolus to Mr. Whitelegge, of the Sydney Museum, who is unable to identify them with any species found in the Australian seas, and is of opinion that they may be new species. Several interesting specimens of Hydroid Zoophytes were obtained, chiefly of the following species:—*Sertularella divaricata*, Busk; var. sub-dichotoma, Bale.

P. L. S., N.S.W., vol. iii. n.s., page 761. S. *microgonia*, Lendenfeld. Bale, P. L. S., N.S.W., vol. iii. pt. 2., s.s. p. 763, pl. xvi., fig. 8. *Halicornopsis avicularis*, Kirch. Bale, Cal. Hydroida, p. 185, pl. x., fig. 1-2. *Aglaophenia divaricata*, Busk. Bale, l. c. p. 162., pl. xv., fig. 7-8., pl. xvii., fig. 6-7. Several species of Polyzöa were brought up, the following species being determined:—*Catenicella Nastata,* Busk, McGillivray, McCoy's Prod. Nat. Hist. of Victoria, pl. 24, fig. 4. *Caberea Darwinii,* Busk, "Voyage of Challenger," vol. x., p. 29, pl. xxxii., fig. 6. *Amphiblestrum cervicorne,* Busk, McGill, McCoy's Prod. Nat. Hist. of Victoria, pl. 25. *Retepora carinata,* McGill, McCoy's Prod. Nat. Hist. Victoria, pl. 97, fig. 7. *R. avicularis,* McGill, l. c. pl. 95, figs. 7-11. *Cellepora rota,* McGill. Trans. Royal Society of Victoria, 1884. *C. albirostris,* Smitt, Busk, "Challenger's" Report, vol. x., p. 193, pl. 34, fig. 7, pl. 35, fig. 3. *Amathia tortuosa,* Tenison-Woods. Trans. Royal Society of Victoria, 1880. *Pustulopora Australis,* Busk, Brit. Mus. Cat. Polyzoa, pt. 111.

Several specimens of an alcyonarian coral were also obtained. *Acanthoisis flabellum,* Wright and Studer, "Challenger's" Report, vol. xxxi. p. 45, pl. xii. fig. 1. Sponges some five or six species were obtained. Examples I intend to have forwarded to Mr. A. Dendy, Demonstrator in Biology, of the University, Melbourne, for identification, who is at present paying considerable attention to the Spongidæ of Australia. Several specimens of Foraminifera were obtained. Mr. Durrand has kindly mounted an excellent slide for the Society, containing several genera.

From the large number of interesting specimens obtained during our recent dredging trip, and considering the very primitive and unsuitable dredge we had to use, I am convinced that a most interesting and valuable collection of marine fauna may be obtained in the Derwent, and have decided that during the summer months I intend to carry out a similar system of dredging to that I was engaged in for the Sydney Museum on the Queensland Coast and Port Jackson during the years 1879, 1881-82.

DISCUSSION.

In reply to His Excellency, Mr. MORTON described the localities where the dredging operations were carried on, and said that the biggest haul of scallops was found round the powder hulks near Government House. One gentleman from England described them as equal to the European quality.

Mr. CURZON ALLPORT said he would expect to find the largest bed of oysters near the entrance to the D'Entrecasteaux Channel. He knew oysters had been taken from there, and believed that many of the oysters found at Brown's River had come from that locality. Touching the scallops, they were at one time very numerous and were brought to market in considerable quantities. He now looked upon them as coming back again of late years like the oysters and mussels. Recently some good specimens had been obtained off Long Point, Sandy Bay.

Mr. MORTON said that since the dredging operations three oysters had been brought in from New Town.

Mr. CURZON ALLPORT said he had seen casual ones this side of Kangaroo Point.

NOTES OF SOME GEOLOGICAL OBSERVATIONS ON THE WEST COAST.

By A. Montgomery, M.A.

During a short visit to the mines of the West Coast in March of this year, I was able to make a few cursory observations of some geological features of the ground travelled over; and a few notes and remarks on these I have the honour to lay before you to-night. Travelling, as I was, rapidly, and for the set purpose of visiting the mines in the shortest possible time, I could not delay long enough to study the numerous interesting questions that presented themselves, and in this paper you will find that I rather state problems than contribute much towards their solution. By calling attention to points requiring elucidation, I hope that the numerous visitors to these till lately almost unknown districts who may have a taste for geological observation, may be induced to notice and record any facts that they may come upon that will throw light upon them. All facts thus noted and made known are stones cut ready for the hand of the builder, who will in time rear them into a noble temple of knowledge. In a newly-opened country we must first collect facts, however disconnected they may be; generalisations from them and complete knowledge will follow in due course. If these jottings, then, serve as foundations for more elaborate work, they will serve their end to the utmost of my hope.

On this occasion my route lay from Strahan to Mount Lyell, thence to the Howard Plains and back to Strahan, then on to Trial Harbour, Mount Zeehan, and Mount Dundas, then overland by Corinna and the Heazlewood silver field to Waratah. It was only such features as were apparent on the roadside that I could see at all. The keys to numerous questions to which I could give no answer may have been lying close at hand, but I could not delay to search for them.

The most interesting subject for geological research on the West Coast appears to me to be the relation to one another and to the sedimentary formations of the numerous igneous rocks, and the influence exerted by these upon the mineral contents of the mining districts. These igneous rocks comprise granite, greenstone, serpentinous greenstone, basalt, and a doubtful rock which may be diorite. Granite forms the mass of Mount Heemskirk and the Meredith Range, and is also encountered on the Magnet Range, near Mount Bischoff. As quartz porphyry and eurite it comes in at Mount Bischoff itself. This porphyry is clearly intrusive through the slates there, as fragments of slate and sandstone are frequently seen embedded in it, and the workings of the Mount Bischoff mine also show it ramifying through the slate. One of the problems to be solved is the relation of this porphyry to the main granitic mountain masses; is it contemporaneous with their upheaval or intruded long subsequent to their formation?

The greenstones and serpentinous rocks are of much interest, more particularly as the serpentine at the Heazlewood is itself the matrix in which metallic lodes are found. There is probably more than a mere coincidence in the fact that serpentinous rocks are found in the vicinity of our three silver-lead fields, Mount Zeehan, Mount Dundas, and the Heazlewood. The intrusions of greenstone are met with in several somewhat widely-separated localities. On the road from Strahan to Mount Lyell, from the Queen River Hotel to about a mile past Lynchford, there is a large greenstone mass, which also is crossed by the prospectors' track from Lynchford to the Howard Plains nearly to the Queen River. As far as I could tell without analysis and microscopical examination, this rock is exactly the same as the greenstones which are so extensively developed in the central and eastern portions of the colony. I did not notice in it the change to serpentine that is shown by some of the other greenstones I have to speak of. Presumably, it has been intruded through the Silurian sandstones surrounding it, but its effect upon these as to local metamorphism, contortion, fracture, and mineral contents, has yet to be learned. It would be instructive to know if the veins and lodes of quartz traversing the Silurian strata are in any way affected by it, or show any evidence of having been caused by it.

Round Trial Harbour for about half-a-mile to the north and east there are steep hills of serpentinous greenstone, which decomposes to a dark red-brown barren soil, containing much magnetic and titaniferous iron ore. It is probably part of the same set of intrusive basic rocks as the serpentinous greenstone found nearer Mount Zeehan, extending for about 3½ miles from above the Agnew Huts nearly to the Comstock mine. At the western side this rock has not been greatly altered, and is much like our common greenstones, but towards the east it gets more and more changed to serpentine. The razor-back ridge on Handley's section at Mount Dundas is somewhat similar serpentine, only finer for ornamental purposes, and contains asbestos and titanic iron ore. Serpentine is also found all along the boundary line of sections

$\frac{2303}{87}$ and $\frac{1851}{87}$, apparently forming the back of the hill into the face of which the Mount Dundas Company's tunnel is being driven. Though the serpentine rocks at the Heazlewood are considerably distant from the above, their similarity in lithological character would lead one to suppose that they also are related to the same series. They first appear on the road from Corinna to Waratah, at about thirty chains past the 21 mile post, at what are called the Eighteen-mile Huts. From there they extend on to past the Heazlewood and Heazlewood Extended mines. On the track from the Heazlewood to the Specimen Reef mine the serpentine extends to about half-a-mile from the crossing of the Savage River. The stone varies very much in appearance, from a greenstone to almost pure serpentine. Parts of it contain much schiller-spar, and closely resemble gabbro. The appearance of all these serpentinous greenstones is consistent with the theory that the rock is a dolerite or gabbro, with its constituents metamorphosed by schillerisation, or internal chemical change, and by weathering, or external atmospheric influences. The more or less complete alteration into serpentine is probably due to the unequal distribution of olivine in the original rock. The change of olivine into serpentine would also account for the formation of the magnetic and titanic iron ore so common in portions of the rock. An interesting deduction from the appearance of these greenstones is that they were once very deeply buried, schillerisation being believed to take place only at great depths. It is possible, then, that these are the roots of one time mighty volcanic masses, possibly covering the western side of the island with their lavas. The microscopic study of these rocks promises a most fascinating field for the petrologist. Should there prove to be grounds for the idea I have advanced, that the volcanic rocks were once much more widely spread than now, the mineral nature of the country would be to some extent explained, the conditions being then such as may be presumed on many grounds to have been favourable for the formation and filling of mineral veins. Every fact that can be adduced to illustrate the history and relations of these intrusive masses will be of service to the cause of geological science in many ways. It has occurred to me that these old matamorphosed igneous masses may possibly represent the lower members of the great greenstone flows that have covered so much of the colony.

Throughout the mineral fields of Mount Zeehan, Mount Dundas, and the Heazlewood, there is another set of igneous rocks that appear to be of quite different character from the greenstones. They seem to be closely connected with the mineral veins, and when more is known about them, I am inclined to believe that the connection will be found to be even closer than it at present appears. They are so much decomposed wherever I have met with them that it is quite impossible to name the rock with any accuracy. As far as can be judged from the decomposition products, it must have been chiefly composed of felspar and hornblende without free quartz, and is likely therefore to be a diorite or hornblende andesite. Till further research reveals its true nature we may without much inaccuracy speak of it as a dioritic rock. I noticed it more especially at the Mount Zeehan and Whyte River Silver-fields, but at Mount Dundas there are also rocks of this series. At Mount Zeehan it is found plentifully on the main road between the Comstock and Silver Queen holdings, some of the belts being close on a quarter of a mile in width. It is notable that the slates in this vicinity are much contorted and broken by small faults, as may be seen in the roadside cuttings. The dioritic rock is most easily distinguished by its coarse granular appearance on the fresh fracture, and by its clayey nature, being almost free from grit. On the surface it forms a stiff yellowish brown clay, quite unlike the dark red-brown clay resulting from the weathering of the serpentines. In the Argent, Balstrup's, Silver Spray, and Western mines it is cut through by tunnels, also in Evans's section $\frac{1110}{87}$, and a dyke of it was noticed in section $\frac{1470}{87}$ of the Tasmanian Silver Mining Company. In Balstrup's and the Western mines it clearly occurs as dykes penetrating the Silurian country slates and sandstones. In the Argent tunnel no lodes were met with in it, but some veins of pyrites and loosely coherent quartz crystals were passed through. The inner end of the adit is in clay slate, the outer half being in the volcanic rock. This has here much the appearance of a tufa, and may prove not to be a weathered dyke penetrating the slates, but a tufaceous bed resting upon them. In the lower tunnel of the Silver Spray company the igneous rock is clearly of a fragmentary character, containing numerous angular fragments of clay slate imbedded in the clayey matrix of weathered volcanic rock. Here we probably have a remnant of a tufa bed, most likely one of many that were formerly widely spread over the district. Some quartz veins were found in this tufaceous rock, and on the surface there is a large mass of gossan, supposed to have been the cap of a lode, until the tunnel was driven underneath it and far past the line of it on the surface without success. Quartz veins and a lode of quartz of considerable size are also found traversing the dioritic dyke in Balstrup's section, and in the similar dyke near the Whyte River on which Godkin's, Smith and Bell's, and the Whyte River company's claims are situated, quartz veins have again been found. The outcrops of both these dykes, too, are marked by large masses of gossan. It appears to me that the weathering of the dioritic rock is of itself quite capable of producing deposits of iron ore on the surface, without there being any lodes required to account for their formation. The ferruginous waters resulting from the solution by carbonic acid of the iron of the rock on coming to the surface are sure to deposit their iron as hydrated oxide. A gossan formed in this way would be rather a bog iron ore than a true lode gossan; and many of the so-called gossan outcrops on these silver-fields appear to me rather to be beds of surface bog iron ore than true gossans. The highly ferriferous serpentine rock has yielded much surface bog iron ore in the same way, as may be seen on the road from Trial Harbour to Mount Zeehan, almost immediately after coming upon the serpentine. Too much importance should therefore not be attached to gossan outcrops as indications of mineral lodes. In this connection, too, I may point out that it frequently happens that quite a small lode has a large "iron hat" owing to the ferruginous waters issuing from it spreading over the surface of the ground. A big "gossan blow" need not cover an equally big lode by any means. In making these remarks I am not forgetting that in Smith and Bell's section the gossan is in at least one place clearly derived from the oxidation of a lode containing much carbonate of iron.

At Mount Dundas I did not notice any dioritic dykes, but in the southern of Webster and Bennett's sections I found a volcanic breccia of fragments of felspathic rock, similar to the diorite. In all probability the igneous rocks will prove to be common at Mount Dundas as well as at Mount Zeehan. Their intrusion may have been the cause of the fractures in which the lodes formed, and the solfataric action accompanying volcanic activity may have had much to do with the filling of the fissures with their mineral contents.

Between the Whyte River and the Magnet Range there is a large quantity of a rather fine-grained greenstone, which does not closely resemble the serpentinous greenstone on the west side of the Heazlewood field. In the cuttings for the road on the long grade down from the top of the Magnet Range, this rock is seen penetrating the slates and altering them to hard brown porcelain-jaspers. I am not at all clear as to whether this is not yet another separate igneous intrusion. Analysis and microscopic comparison with the other greenstones are required to solve this problem, together with field observations to the northward of the Whyte River silver-field, where the Magnet Range greenstone seems likely to join with the serpentine rocks.

The basalt dykes and flows met with on the West Coast all probably belong to the series of tertiary basalts found abundantly along the North and North-West Coasts. About 10 miles and 8 miles south of Corinna I noticed two dykes or streams of basalt crossing the road, the first about a quarter of a mile wide, the second about half that width. It occurs again at 21 miles from Corinna on the road to the Heazlewood, and on the track to the Specimen Reef at about one and a half and quarter miles from Hall's Creek. Round Waratah it is rather extensively developed. Looking southward from the top of Mount Bischoff it appears likely that the plateau, out of which Mount Pearse stands up like an island from the sea, is all basalt. If this is the case there is a very interesting geological problem here, to determine as far as possible the configuration of the country previous to the lava flow. This may have important economical results in leading to the discovery of buried tin-bearing leads heading from Mount Bischoff. Ever since the discovery of this wonderful ore deposit, the small quantity of alluvial tin ore found in the creeks running from it has been a subject of surprise to observers, and the existence of leads buried under the basalt has frequently been conjectured. The interesting leaf beds underlying the basalts at Waratah have more than once been brought under the notice of this Society. As usual, the basaltic soil appears to be very fertile, and in the event of a large population becoming established on the West Coast, these strips of good land will doubtless be very valuable for farming purposes.

The questions connected with the igneous rocks are by no means the only interesting geological problems that present themselves. Others there are in profusion, apparent even to the cursory glance of the passing traveller. I may mention some of these, not to throw any light upon them, but merely to direct attention to them. The Tertiary leaf beds fringing Macquarie Harbour have been scarcely at all studied as yet, though Dr. Milligan and Mr. R. M. Johnston have made a valuable beginning and given us a glimpse of the riches there awaiting both botanist and geologist. The sand dunes through which the railway passes between Strahan and the Henty River also deserve some attention. They extend inland from the beach for a very considerable distance, and are now covered with a dense growth of ti-tree scrub. Are they overlying the leaf beds, or do they lie against the face of an escarpment of these such as we see at Strahan? The latter seems to me at present the more likely. But apart from their geological age these dunes suggest some interesting questions: How have they been formed? Have they been caused by the sand being blown inland from the beach, as we know sand dunes frequently are formed, encroaching on low-lying coast lands and gradually covering them, or has their growth been quite in the opposite direction by the sand accumulating on the beach gradually extending further and further seaward, and so reclaiming a strip of shore? If, as seems likely, Macquarie Harbour once had a wide mouth instead of a narrow one, and the sand driven southward by the north-westerly winds has gradually formed a sandspit from Strahan to the Heads, it seems likely that the dunes represent successive lines of sandhills formed above high water mark, and that the land has been reclaimed by the constant deposit of sand brought in to the shore by the action of the winds and waves. The reclamation would be similar to that which often takes place in the angle where a breakwater meets the shore line on the side exposed to the prevailing winds and currents. In this case Cape Sorell and the strong current from the Harbour would be the obstacles preventing the further southward travel of the sand, and causing it to accumulate on the beach to the northward. If this suggestion is correct, the depth of the deposit of sand is probably considerable, much more so than if the dunes were formed by the action of wind alone. Perhaps some of the railway cuttings may throw some light on the question. It is interesting from an engineering as well as from a geological point of view, and has a certain bearing upon the proposed harbour works at Macquarie Heads. From its geological aspect, a section through such a sand deposit as I have indicated would exhibit an instructive succession and overlap of horizontally bedded sands, false bedded sands, and blown sands.

The gravel deposits in the neighbourhood of the Pieman River and along the road from Corinna to Long Plains deserve some attention. They cover a large extent of country, and are found at very various levels, and they appear to have been laid down when the river systems were not altogether as they now are. As gold has been found almost universally in these gravels, though in small quantity, they may become of economical importance, and leads may be found in them. Their distribution and formation are therefore worthy of study.

An alluvial deposit at the Linda River, in the neighbourhood of Mount Lyell, where sluicing operations for gold are being carried on, also came under my notice. The streams that piled up the auriferous gravels were probably much larger than those now existing. Under the gravel there is a peaty bottom, containing very numerous fragments of wood, apparently of one of the pine family. Below this bottom another layer of gravel has been found in places. Search would probably reveal leaf beds, from which valuable information might be obtained. The alluvial flat through which the Linda Company's tail-race runs, may very probably have been at first a small lake, then gradually filled up to a marsh, and finally covered over with a layer of gravel. If so, what force scooped out the Lake basin? Was it a glacier, or has a landslip blocked the exit from a valley, and so formed a lake?

There are any number of other points on which information would be useful, sometimes purely in the cause of science, but oftener, perhaps, on account of their bearing on the mining industry; but in rapidly traversing the district as I did, it was of course impossible that I could take any note of nine-tenths of them. For example, I had no time to look for fossils, though some of the localities passed through are evidently rich in them, and if one had the opportunity of examining them, doubtless many discoveries would result. A cutting in the main road close to the Government township of Mount Zeehan is especially rich, and will doubtless be much visited by collectors on account of its easy accessibility. The sandstones between the Heazlewood and Whyte Rivers are also fossiliferous.

In conclusion, I have to say that these notes are given for what they may be worth as to the facts related in them, for I confess I attach no importance to any theories I have indulged in, and am quite prepared to find that further exploration will disprove them, or cause them to be altered beyond recognition. If I have succeeded in drawing your attention to the extent and variety of the geological harvest that stands waiting to be gathered, I shall have done all that I can hope for at present.

At some future time, after the more elaborate examination of these districts, which, as time goes on, I hope to have opportunities of making, I trust that I may have the honour of bringing under your notice solutions of some of the problems that to-night I have only been able to mention as existing.

OBSERVATIONS ON THE INFLUENCE OF STRIKES UPON REAL WAGES.

By R. M. Johnston, F.L.S.

At the present moment in Europe, America, and Australasia, many industries are paralysed and the well-being or comfort of thousands of families are more or less sacrificed by organised or enforced idleness involving a considerable diminution in the creation of commodities or real wealth. These Strikes, as they are termed, are entered upon by thousands of honest, hardworking, peace-loving men. In loyalty to their order and to their recognised leaders, they display many characteristics which cannot but excite some degree of wonder and admiration; for this voluntary suspension of the means of livelihood to them not only involves unflinching self-denial of ordinary comforts, but also the facing of a terrible risk that in the dark, prolonged struggle, the lives of those that make life dear to them may be crushed and overwhelmed by want and misery.

Facing such risks, it is only natural that the ordinarily peaceable man should become restless and excited, nay, violent, when the campaign of self-sacrifice and loyalty to their fellows seems about to be jeopardised by the opposing action of those who seem to them to be lawless renegades of their order.

Those of the community whose interests are in conflict or are not supposed to be immediately affected by a combined strike—whether for shorter hours, resistance to the lowering of the rate of wages, or the raising of wages—may be surprised and may condemn "unionists" on Strike for violently opposing the filling up of their places by so-called outsiders, freemen, non-unionists or blacklegs, but a little consideration from the standpoint of "Put yourself in his place" will reveal much that tends to palliate their modes of action or behaviour, if it does not exonerate or justify them. Be it remembered that their hope of success entirely depends upon their loyalty to each other under the most severe strain to human beings, viz., privation and misery; that their battle squares, if broken entails defeat; that the breaking away of any of their number or the intrusion of opposing outsiders destroys all their hopes, make their prolonged sacrifice of no avail, and leaves them in a much worse position than at first.

On the other hand (making allowance for mistakes in judgment), there is much that is admirable in the sympathetic, sacrificing support of brother workmen in other trades or divisions of labour, who, although not themselves immediately concerned, yet voluntarily resolve to help by docking 1s. per week from their own small earnings, nay, often sacrifice for a time their earnings altogether where it is thought that a Strike in their own branch would serve more speedily to bring their brother-workers' campaign to a successful conclusion.

In the present day—with its hard and fast divisions of labour, its fluctuations of demand and supply, its hordes of unemployed, and its crushing competitive rings and interests—the intelligent wage-earner perceives plainly enough that as a unit he is perfectly helpless, and that he can only succeed in bearing up against opposing organised interests by a similarly organised action.

No one who has closely followed the struggles of workmen during the last thirty years can fail to perceive that upon this organisation (solidarity) rests the whole strength of their position in the industrial scheme, and that anything which tends to weaken or demoralise their centres of organisation, meets with their most strenuous resistance; for it is manifest to them that the breaking or weakening of the heart or centre of their organisation detaches them again to helpless units who are unable to enforce any claim whatever.

It will be conceded, therefore, when it is proposed to ask the question, *Can Strikes raise Real Wages of Wage-earners all round?* that the writer is one who regards combination or co-operation amongst wage-earners as of paramount necessity to them, and that when all better modes of appeal for reasonable concessions are unavailing, the last and terrible resort "to Strike" may in certain cases not only be justifiable but imperative.

STRIKES CAN ONLY SUCCEED IN RAISING *Real Wages* WHEN IT IS PARTIAL OR CONFINED TO INDUSTRIES THAT COMPRISE A SMALL PROPORTION OF THE COMMUNITY.

While much has been granted in favour of organisation, and the right to resort to Strikes under certain circumstances, it cannot be concealed that many expect by organised Strikes to effect what is plainly an utter impossibility, even if employers gave way at every point.

A Strike may be the means of successfully raising the status of some branches of labour that are comparatively underpaid or over-worked; it may raise the *real wages* of a particular country or locality which formerly laboured under the average remuneration of other countries; it may temporarily be the means of forcing the capitalist or employer to give a fairer or larger share of the profits of capital and labour—*i.e.*, machinery plant, skill, and labour—but from the very nature of the common source of all profit and wages [viz.—the *current products* created by the combined services of capital (instruments) and labour], Strikes cannot raise the *real wages* of *all* wage-earners.

In other words, it is possible to regulate and alter the distribution of the aggregate wealth of consumable necessaries of life, but so long as this aggregate wealth fails to be increased per capita per year, Strikes cannot increase the *real wages* or the purchasing power of a day's labour of *all* wage-earners. In a word they cannot divide more than what has actually been created or produced, although the *nominal rates of wages* and *nominal prices of commodities* may both be raised to any extent without real benefit to anyone.

To secure a general nominal rise of wages in *all* branches of labour would further have the immediate effect of lowering once more the *real wages* of those who already had effected for themselves an advantage by successful combination or Strikes. This may seem hard to believe by many who have not taken the trouble to discern the fundamental distinction which exists between *real wages*—which alone can improve the workman's condition—and *nominal wages*, which, if raised ever so high, in all branches of labour, leaves the workman just in the same condition as at the beginning.

But, directing the attention to the fact that there is an important distinction, it may prepare the more thoughtful to contemplate that there is something underlying these terms which they would do well to understand, for it cannot be too often asserted that Strikes might possibly raise the *nominal wages* of workers all round a hundred-fold, and yet result in the positive lowering of the *real wages* of all workmen who, by means of organisation, hitherto have succeeded in bettering their condition as compared with their less perfectly organised fellow-wage-earners. It is the failure to recognise the essential difference between *real* and *nominal wages* that renders futile the many schemes of sentimentalists, which have for their object the laudable design to improve the condition of the people.

Real and Nominal Wages.

No one has more clearly defined the nature of *real* and *nominal wages* than Mr. George Gunton, in his admirable work "Wealth and Progress." He states (p. 74): "By *real wages* is meant the actual amount of wealth (social well-being) obtainable by a day's labour. By *nominal wages* is meant the amount of *money* obtainable by a day's labour." In other words *real wages* means the actual purchasing power of a day's labour, while *nominal wages* may or may not always afford a correct index of the comparative purchasing powers of a day's labour. For example, in England the minimum supply of the necessaries of life for a workman and his family for one day may be secured by a nominal expenditure of 4s. in money. If his nominal or money wages for a day of nine hours be 5s. then the purchasing power of his real wages for one day's labour is equivalent to the command over 1 1-5th days of the necessaries of life. If the same necessaries exactly in America cost a nominal or money value of 6s., it follows that a nominal or money wage of 7s. 2·4d. for a nine hours day in America would only have the same purchasing or real wages value as the nominal or money wage of 5s. per day in England.

Now, as it can be shown that the nominal cost of a day's labour mainly determines the ultimate nominal cost of the commodity, product, or service related to that effort, it follows that if *nominal wages* all round were arbitrarily raised 20 per cent. without actually increasing products, it would inevitably result in raising the *nominal* prices of commodities or necessaries all round to the same extent, and thus leave the purchasing power or *real wages* of the labourer in the same position as at first.

It has been purposely assumed that this effect would only be brought about where the arbitrary increase to *nominal wages* was equally spread over all classes of wage-earners; for it is not denied that an arbitrary increase to *nominal wages* if restricted to a few industries might increase both the *nominal* and real wages of these trades; but in all such cases it would be obtained by a proportionate *decrease* of the purchasing power or *real wages* of every other class in the community who were obliged to purchase the products so enhanced in price of the various industries who succeeded in having the *nominal* wages so raised. It is the consumers of products or services who would ultimately lose by the advantage gained by the industries whose wages were nominally raised, and not the capitalists and employers who directly were obliged to advance the *nominal wages*.

It is only under such restricted circumstances where Strikes could really benefit any industry by raising *real wages*. They would of necessity fail to raise *real wages* if the *nominal wages* of every class were raised by the same percentage of increase as has already been explained. Unfortunately the workers in many industries whose labour is worst paid (*e.g.*, seamstresses and agricultural labourers) lack organisation, and thus fail to improve their position among other labourers, although the nominal cost of the necessary satisfactions of life is the same to them as to the better paid wage-earners. But here again it must be borne in mind that any increase in *real wages* gained by them by the nominal raising of wages could only be secured where the *nominal* increase to wages is restricted to a few industries. This is made all the more apparent when we try to estimate (however roughly) the composition, numbers, and nominal earnings of the various classes of any Society.

It is impossible with our present knowledge to gauge all such conditions accurately, but if, for example, we divided all Breadwinners—Rich and Poor—into, say, five distinct groups, thus—

		ASSUMED PROPORTION.		
1. Upper Class Rich, say	...	1	per cent. of	Breadwinners.
2. Middle Class „	...	5	„	„
3. Higher Industrial and Artisan „	...	15	„	„
4. Middle Industrial „	...	20	„	„
5. Lower Industrial „	...	59	„	„
		100		

If, further, the total satisfactions secured per day amounted to £33 6s. per 100 Breadwinners, and were divided as follows:—viz.: for the 1st, 40s.; 2nd, 20s.; 3rd, 10s.; 4th, 7s.; 5th, 4s., we may ask—What, then, would be the effect upon all if the satisfactions were equally distributed according to the day's labour, disregarding the nature, quality, or quantity of the work or service performed by the various classes? Some indication of the effect that would be produced is shadowed forth in the following table:—

	Per-centage pro-portion.		SATISFACTIONS PER DAY Assumed existing proportion.	SATISFACTIONS PER DAY Total. s.	Total Satisfactions if equally distributed. s.	Increase or decrease per cent.
1. Upper Class Rich	1	@	40s.	40	6·66	— 83·3
2. Middle Class	5	@	20s.	100	33·30	— 66·7
3. Higher Industrial & Artizan	15	@	10s.	150	99·90	— 33·3
4. Middle Industrial	20	@	7s.	140	133·20	— 4·8
5. Lower Industrial	59	@	4s.	236	392·94	+ 66·5
TOTAL OR MEAN ...	100		6·66s.	666	666	——

From the preceding table it would appear that if all classes shared equally in the satisfactions assumed to be created by the aggregate labour of men, only the lowest would receive a positive increase, while the four higher would lose a considerable per centage, amounting to a decrease from 4·8 per cent. in the Middle Industrial to 83·3 per cent. in the Upper Class Rich share. Even the Higher Industrial and Artizan Class, who often dream that a redistribution of wealth would be to them of untold advantage, would, as shown, probably lose 33·3 percentage of their present allotted share of created satisfactions if the world's created wealth were equally distributed among all men.

This equality of distribution is the dream of many

NOTE. — Indicates Decrease. + Increase.

Socialists, whose present share of the satisfactions of life would certainly have to be lowered, not raised, if their visionary schemes could be carried into effect.

In conclusion it seems only too true, as asserted by Mr. Gunton, "That nothing can improve the social condition of the masses, whether it raises nominal wages or not, which does not increase the general rate of *real wages*, the degree of which may be universally taken as the accurate measure of social progress;" and, "there are no economic means by which the material condition of the masses can be permanently improved which do not tend to increase the aggregate production of wealth per capita." Invention, increasing command over the forces of nature, thrift, and industry can alone accomplish this. Schemes of Distribution and Strikes for higher nominal wages must end in failure and disappointment, so far as the great masses of men are concerned.

It would be well for capitalist and wage-earner, employer and employed—whose interests as producers and *consumers* are almost identical—that when matters requiring adjustment are proposed, there should be greater facilities afforded in the Councils of both interests for securing a friendly settlement. So long as high-handed action on either part bars the way to the friendly conference of *acknowledged representatives* (except after the bitterness and friction of an industrial war), so long will the unsatisfied claims, the suspicions and misunderstandings of both parties, result in injury to both; and to the absence of these facilities, mainly, may be attributed the most disastrous of all such evils, viz. Strikes.

CAN STRIKES REALLY IMPROVE THE CONDITION OF THE MASSES?

BY A. J. OGILVY.

The question—the very serious and practical question raised in Mr. Johnston's late interesting paper is this—Can the toiling masses really improve their condition by these incessant and unhappy Strikes, or are they only beating their hands against the iron bars of inexorable Economic Law?

That, at any rate, whether it exactly represents what Mr. Johnston meant or not, is the great question of the day; and it seems a very plain question. Yet, plain as it seems, one or two other questions appear to have got rather mixed up with it which are no part of it all. For instance, the question is not whether if all nominal *incomes* were raised real incomes would be raised too, and that if everybody had twice as many shillings, other things being unaltered, everybody would be twice as well off.

The most ignorant striker does not imagine this for a moment. He understands perfectly well that the increased pay that he expects to get must come out of somebody else's pocket. Neither is the question whether "men can divide amongst themselves more than is created or produced." Of course not. We might as well be asked to debate whether 2 and 2 could make 5. That is not the great Strike question.

Briefly summarised, the proposition placed before us in Mr. Johnston's paper is that strikes, if carried out on any extended scale, must fail, because a mere increase of nominal wages, unaccompanied by any increase in production, cannot really improve the condition of the masses. The aim of this paper is to show that it can. The proposition indeed ought to be reversed and stand thus:—No increase of production can improve the condition of the masses unless accompanied by an increase of nominal wages. The nominal wages are the main thing, because it is not an increase of production, but an alteration of distribution that is aimed at.

What we are concerned with is an increase of *wages*, that is, of the income of the *masses*: of the lower 10 millions whose toil is the active factor that produces all wealth, not of the upper 10 thousand who in some mysterious way manage to get rich upon that toil.

Society, in the view of the masses, may be roughly divided into 3 classes:

(a.) Those who derive income absolutely without any effort of their own, and consequently from the efforts of other people. Of these are receivers of ground rent, holders of state bonds, money lenders, shareholders in companies, and so on.

(b.) Those who do contribute some effort, but effort absurdly disproportionate to the income they receive. For example, the manufacturer who makes some thousands a year by only some 4 or 5 hours attention to business a day, while his factory hands only get £1 a week or so for some ten hours work a day.

(c.) Lastly come the toiling masses who bear practically the whole burden and heat of production, and yet gain but a mere subsistence. This last class thinks that the two first classes get much more than their fair share, and it strikes in order to make them disgorge. A strike, then, is a movement of the underpaid against the overpaid.

Whether the two first classes do really get more than their due is a matter that we have nothing to do with at present. We are not concerned with the ethics of the question. All we have to enquire is, not whether strikes *ought* to succeed, but whether they *can*.

In the primary industries, that is in those which are concerned in extracting or producing the raw materials of wealth from the land (as in agriculture and mining), where certain lands only are suitable for the purpose (as for instance fertile lands for agriculture, and mineral lands for mining), and the intending users are much more numerous than the owners, there is keen competition for possession of such lands, and the competitors run each other up in rent. In all such industries every increase of wages will come out of the rent. For rent (or, at any rate, that portion of it which we are now concerned with) is simply the surplus which remains after paying working expenses and tenants' "ordinary profit;" and every rise in the expenses or fall in the profits will reduce the rent proportionately. Take agriculture. In every lease the rate of wages and the price of produce is tacitly accepted on both sides as the basis of the whole calculation; and both landlord and tenant understood quite clearly that if wages rise or prices fall, not as a mere fluctuation, but with every appearance of "settled weather," the rent will have to be re-adjusted at the first opportunity. But royalties on minerals are but rent under another name, and are determined by exactly the same calculations. Think what a vast area of industry, and how great a body of workers are represented in this category! It includes the raising of every description of crop, and all grazing, dairying, and many other products; also all coal, iron and metal of all sorts, building stone, slate, lime, china, and brick clay, and minerals too numerous to mention, in all which every increase in the cost of the working will come out of the rent. It covers also not only all those who are actually on the land, but all who are directly or indirectly engaged in providing the appliances or placing the product in the market. A strike of the seamen who carry the coal, or of the artificers who make the mining appliances, will fall on the landlord as surely as will a strike of the actual miners, and for the same reason, viz.: that it increases the cost of placing coal in the market, and so leaves a less surplus available for rent. In every department of industry, then, which is concerned in supplying the raw material of wealth from the land, every enforced rise of wages will be clear gain to the labourer, because the loss will fall upon the landlord, *and stay there.*

But in the secondary industries; in those industries which are concerned, not in extracting the raw materials of wealth from the land, but in working up and distributing those materials (as in manufactures and commerce), in which the land is not an active factor, so to speak, in the work, but is required only as a site, one site doing (within certain limits) as well as another, where consequently trade competition is not for possession of the land but for custom, and the competitors run each other down in price instead of running each other up in rent. In all these industries increased wages will signify increased price of goods.

But these goods again are of two kinds, those which the masses consume, and those which they do not. On those which they do not consume no increase of price will affect them.

Few people realise how vast a proportion of the industry of a rich country like England is concerned in providing luxuries and enjoyments for the rich. Taking goods only, and putting mere services aside, one has only to walk down the street glancing in at the goods displayed in the shop-windows to see that the greater part consists of goods quite out of reach of the masses, and in which consequently no increase of price will concern them. The butchers and bakers, the grocers and the clothiers, are the chief shops which the masses deal with, and even in these, in the two latter at any rate, the greater quantity, whether measured in variety or in value, consists of articles of luxury available only to the well-to-do; while in many shops the display exhibited contains hardly a single article within reach of the poor.

In all those commodities, then, which the underpaid do not consume, the loss due to increased wages will fall upon the overpaid, *and stay there*, again leaving the whole net gain to the labourer.

Lastly we come to those goods which the masses do consume, and which will rise in price. Here the strikers will suffer a loss, but the loss will not equal the gain even on these goods. In the case of primary products, such as food, the greater part of the loss due to increased wages will, as we have seen, be deducted from the rent instead of added to the price.

In the case of secondary products, manufactured goods, as say for example *boots*, the cost will be added to the boots; but it will not be all piled upon the labourer's boots, the boots of the overpaid will bear their share. If in consequence of a bootmakers' strike an increase of *£1,000* in wages had to be paid for a given turn out of boots, then *£1,000* would have to be added to and distributed amongst that turn out of boots; the overpaid would have to bear all the added cost that accrued to their boots, leaving the underpaid to bear that part only which accrued on *their* boots; and the share that the overpaid will have to bear on their boots is not to be measured merely by their numbers, for the boots used by a rich man are generally much dearer, representing a good deal more labour than the boots used by a poor man.

To sum up so far, let us express the argument in figures; not pretending for a moment that the figures are even approximately correct, but simply to illustrate our meaning.

Suppose then that in consequence of a series of concerted strikes among the whole class of labourers wages generally were increased by £30,000 a month, we might say that—

10,000 would be taken off rent instead of added to price.

10,000 more would be added to price, but to price only of goods which the strikers did not consume.

And of the remaining *10,000*, ⅕ (or *200*) would be paid by the richer classes who consumed their share of such goods, leaving only *8,000* to be borne by the strikers on *their* share.

The profit and loss account to the strikers would then stand thus—

Taken out of rent and added to wages ...	10,000
Levied on rich purchasers of luxuries and added to wages	10,000
Levied on necessaries and small comforts and added to wages	10,000
Total	30,000
Deduct increased price on strikers' own purchases	8,000
Net gain to the strikers	22,000

It is said, however, that if the upper classes lose so much there must be so much the less employment for labour, and so the loss will come round to the labourer after all.

There will be no less employment.

For why will the upper classes have got so much less? Simply because the lower class has got so much more. It is not a loss but a mere transference of employing power. What the masses want more money for is to spend it, and they can only spend it in purchasing goods and hiring services just as the upper class did. They will in short, to the extent of the transference, be employed by each other instead of by their old employers.

My time being limited, I have been obliged to state my case in broad outline, without going into details and qualifications, but there are one or two such qualifications, real or apparent, that we may have time to glance at.

1. There is of course a limit to the rise of wages. The labourer cannot earn more than his labour produces. But this limit is a long way off; what the labourer actually gets is a very small portion of what his labour really produces; and the question before us is not whether there is such a limit, or how far off it is, but whether strikes, as strikes, can under present circumstances really improve the labourer's condition or not.
2. It will be said that the fall of rent which we have predicted will throw some lands out of use, and so actually diminish the total production of wealth. That is to say, that land that now yields current wages to labourers, and profit to employers, but only a small surplus for rent, will then yield no rent at all; in which case the landlord will withdraw such land from use and devote it to his own amusement, say for sport.

Well, that opens up a question about which you will hear more before long, viz.: the question whether a man who claims to be sovereign lord and master of a certain portion of the earth's surface shall be allowed deliberately to prohibit all productive industry on that area, to forbid willing labourers from working, and enterprising capitalists from investing merely because such enterprise will not yield blackmail to him, as well as profit and wages to the workers.

But passing that by, I would point out:

1. That a more equitable distribution of the produce of labour is a boon so great in itself as to be well worth some cost, and that we need not be dissatisfied because less luxuries are produced for the few very rich, if more comforts are provided for the many poor; not even though the loss in value on the luxuries exceeds the gain in value on the comforts.
2. That it is only the very worst lands that will be withdrawn, and the loss through the withdrawal of these worst lands will be more than compensated by the more effective utilisation of the better lands; for these better lands will now be tilled by better paid men, and well paid labour is more effective than badly paid labour.

Allow me here to quote a short extract on the advantage of high wages.

"But high wages are not only a sign of progress, they are also a factor of progress, and this in three ways:—

1. When the labourer is well paid he becomes more intelligent and skilful, more self-respecting, a better man all round. I do not mean that wherever the labourer is poorly paid he is dull, unskilful, immoral, and that wherever he is highly paid he is all that he ought to be; for many agencies go to the making of character besides the rate of wages. But I mean this: that, given any labourer of the character that he is, however produced, higher wages will make him better, not worse—more efficient, not less.

2. High wages induce clever men to invent, and compel slow men to adopt labour-saving contrivances of all sorts, and so add to the productiveness of labour. Employers do not bother themselves about inventions where labour is dirt cheap. In the making of the Suez Canal, the sand was excavated with common hoes, and carried out on women's heads, though steam excavators and elevators were well known, and would have saved nine-tenths of the labour. But the labour wasn't worth saving—to the contractors. Improved appliances in agriculture are in much more general use in America and Australia, where wages are high, and because they are high, than in England; and more in use in England than on the Continent, for similar reasons.

3. High wages, like free-trade, help to weed out weak industries, and to concentrate labour where it is most effective, as already pointed out." *

It may be said again that the increased price referred to of goods consumed only by the upper classes will diminish the consumption, and that to that extent the labourer will fail to shift the burden of his increased wages on to the rich consumer. Granted. But the effect of this would merely be to diminish the successfulness of strikes, and the question before us is simply whether strikes *when they are successful* can really improve the labourer's position. I have tried to show that they can. It is for the present company to decide for themselves whether I have succeeded.

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* Extract of a paper, "Land Nationalisation," by the author (reprinted by permission), from the Co-operative Wholesale Societies' Annual, 1890, and issued by the Land Nationalisation Society: Manchester, 1890.

GENERAL INCREASE OF WAGES FALLS UPON CONSUMERS OF PRODUCTS, AND IN NO WAY ENCROACHES UPON RENT OR PROFITS OF CAPITALISTS.

By R. M. Johnston, F.L.S.

Different observers standing at different points of view in the midst of many complex problems are hardly ever likely to concur in each others conclusions if their respective views are limited to a few isolated facts, belonging to but still forming an insignificant part of the whole series of facts upon which the true solution of the complex problem depends. Each observer under such conditions may arrive at opposite conclusions, which may be perfectly consistent with the fragmentary data upon which they respectively rest, and yet be altogether wrong and inconsistent when correlated with the more important series of *co-efficients* which were overlooked or ignored.

The conclusions of even the most extended observations may also be consistent with the data upon which they are based, and yet be altogether inconsistent with the truth, if the data themselves be inaccurate. Further, there are always some points so difficult of solution that only the powerful restraint of a particular habit of mind or training can prevent ones sympathetic leanings from leaping the gap to the goal desired in preference to the wiser course of making further exploration or waiting for further gleams of light.

These observations are necessary when called upon to review the arguments of Mr. Ogilvy, in so far as they are supposed to touch upon my former paper on Strikes and their Influence upon Wages. It affords me great pleasure to find myself in agreement on so many points with one like Mr. Ogilvy, whose well-known generous sympathies for the amelioration of the condition of the masses of the people must command the respect of all right thinking persor We are substantially in agreement in the view stated by in my former paper, that "A strike may be the means of su cessfully raising the status of some branches of labour tha are comparatively under-paid or over-worked; it may raise the *real wages* of a particular country or locality which formerly laboured under the average remuneration of other countries; it may be the means of forcing the capitalist or employer to give a fairer or larger share of the profits of capital and labour—*i.e.*, machinery, plant, skill, and labour—but from the very nature of the common source of all profit and wages, viz., the current products created by the combined services of capital (instruments) and labour, strikes cannot raise the real wage of *all* wage-earners."

In other words, it is possible to regulate and alter the distribution of the aggregate wealth of consumable necessaries by means of strikes.

So far there is a substantial agreement between us.

It is in the following statement made by me wherein our views are in diametrical opposition, viz.:—(1.) "It is not denied that an arbitrary increase to *nominal wages*, if restricted to a few industries, might increase both *nominal* and *real* wages of these trades; but in all such cases it would be obtained by *a proportionate decrease of the purchasing powers or real wages of every other class in the community who were obliged to purchase the products enhanced in price of the various industries who succeeded in having the nominal wages so raised*," and more especially is the fundamental difference between us set forth in the next paragraph used by me, viz.:—(2.) "It is the *consumers of products or services who would ultimately lose* by the advantage gained by the industries whose wages were nominally raised, *and not the capitalists and employers as such who directly were obliged to advance the nominal wages*." And again, we are diametrically opposed in relation to the following observations of Mr. Gunton's, with which I am completely in accord. (3) "That nothing can improve the social condition *of the masses*, whether it raises the nominal wages or not, *which does not increase the general rate of real wages* (*i.e.*, purchasing power) *the degree of which may be universally taken as the accurate measure of social progress*," and "there are no economic means by which the material condition of the masses can be improved which do not tend to increase the aggregate production of wealth per capita." And these differences between us—as regards the means by which alone the condition of the masses can be improved—are finally summarised by me in the statement: "Invention, increasing command over the forces of nature, can alone accomplish this. Schemes of distribution and strikes for higher nominal wages must end in failure and disappointment, so far as *the great masses of men are concerned*."

In opposition to these three statements Mr. Ogilvy makes the following observations, to all of which I am sorry to give a categorical No!

(1) That "No increase of production can improve the condition of the masses unless accompanied by an increase of nominal wages."

(2) "In the primary industries, that is those concerned in extracting or producing the raw materials of wealth from the land (as in agriculture and mining), every increase of wages *will come out of the rent*;" and again, "Every department of industry (including carriers by sea and land) which is

concerned in supplying the raw material of wealth from the land, every enforced rise of wages will be clear gain to the labourer, because the loss will fall upon the landlord, *and stay there.*"

It is remarkable that Mr. Ogilvy's usual penetration should in these two propositions have so far failed him that he did not perceive that their support wholly rests upon old economic fallacies long since exploded, and discountenanced by the best, if not nearly all, modern economists. Even Mr. Henry George does not support these old economic fallacies, associated with "The Theory of Rent" and "The Wages Fund;" and yet, notwithstanding this, Mr. Ogilvy's conclusions regarding rent and wages depend wholly for support upon the resusicitation of those old fallacies which so long darkened men's minds regarding the true theory of rent, and the true relations between rent, profit, wages, production, and prices.

Theory of Rent.

"Ricardo's Law of Rent," now almost universally accepted by economists, is so well established by reason and experience that even Mr. Henry George is forced to admit that "its mere statement has all the force of a self-evident proposition." It is thus set forth, according to Ricardo:—

"*The rent of land is determined by the excess of its produce over that which the same application can secure from the least productive land in use.*"

Or, as stated more specifically by Mr. F. A. Walker:—

"*The rent of any piece of land is determined by the difference between its annual yield and that of the least productive land actually cultivated for the supply of the same market, under equal application of labour and capital.*" (P. 197, "Political Economy," London, 1887.)

If this be granted, we have the following distinguishing elements:—

Let R = Excess of Produce over that of the least Productive land actually cultivated for the supply of the same market under equal applications of Labour and Capital = Rent.

N = Produce of the least productive land actually cultivated under similar conditions to R.

C = Profit of Farmer and Capitalist.

W = Nominal Wages of Labourer.

P = Produce of Land, Labour, and Capital.

D = Demand of Consumers.

D^m = Maximum Purchasing Power of Consumer.

D^n = Minimum Purchasing Power of Consumer.

P^{rm} = Maximum Nominal Price of Products.

P^{rn} = Minimum Nominal Price of Products.

Then $R + N = P$ or Supply

$$\frac{C + W}{D^m} = P^{rm} \text{ or Price Maximum.}$$

$$\frac{C + W}{D^n} = P^{rn} \text{ or Price Minimum.}$$

Now it can be seen at once, if these premises be granted, that as the application or efforts of labour receive the same reward whether engaged upon the least (N), or most productive land in cultivation (R), that any alteration in the rate of wages, *if general*, would not affect the proportion falling to R, no matter whether the nominal wages rose or fell; for R (rent,) is solely determined by N, and—excepting cases where employment and area under cultivation are curtailed—is in no way concerned with the rate of wages. The *surplus*, *R* (*rent*), has not come into existence as the sole work of labour; for in relation to the laws which determine price it is a measure of the gift of nature monopolised in the hands of landowners as rent. It is the fluctuations of demand (D) which directly affect the value of products coming to R, and not the scale of wages, whether high or low, so long as the scale is general. As about 52 per cent. of the breadwinners in various countries depend upon agriculture and pastoral industries, it is also clear that if the increase of their wages was only local, or partial, the condition of the great mass of workers would not be improved.

Going back to our analysis it follows that

$R + N = P$ or produce of land, labour, and capital or = Supply.

Seeing that supply and demand are among the principal factors in determining price or nominal value in the market and as these are ever varying factors, it follows that nominal value or price ever fluctuates with the variations of (P) supply and demand (D). Thus—

$$\frac{R + N}{D} \text{ or } \frac{P}{D} = P^r \text{ or Price.}$$

But the actual cost of products being determined mainly by the cost of labour and machinery cannot fall below the actual aggregate cost of the standard of living for the labourer and the actual cost of maintaining the capitalist's machines and instruments.

On the other hand, the nominal value for products divided between $R + G + W$ cannot be increased *much above* the minimum producing cost without operating upon demand through the lowered purchasing power of the consumer, and so producing a check, or temporary equilibrium.

From this reasoning it follows that the surplus produce (R), while increasing the general store, and thus tending to lower prices to consumers, yet rent or earnings of landlords *per se* do not enter into the market price in any way, and therefore do not increase the price of products to consumer.

Therefore it follows that the ultimate exchange price, whether maximum or mimimum, is wholly determined thus :—

$$C + W \left\{ \begin{matrix} + (D^m - D \\ - (D - D^n \end{matrix} \right\} = \left\{ \begin{matrix} P^{rm} \\ P^{rn} \end{matrix} \right.$$

How, then, can any arbitrary increase or decrease of W affect R (rent), except in an indirect way, by its effect upon consumer, who certainly would have his real wages or purchasing power diminished correspondingly with any arbitrary increase to the *nominal wages* of W.

It can be shown, in a similar way, that the profit of the farmer, or entrepreneur, and the interest of Capitalists are determined solely by competition with each other, and are in no way affected by cost of machinery or wages of labour so long as these latter elements of cost are common to all competing farmers, entrepreneurs and capitalists. In all their enterprises *such charges* PLUS their own *profit* (solely determined by comparative skill, enterprise and competition) make up the final cost of products which *does not stay with the landlord or entrepreneurs*, but is passed on, and wholly borne by consumers; and therefore it is as *consumers* (not as landlords, farmers, entrepreneurs, capitalists or wage-earners) that all classes concerned in production are affected by any arbitrary increase to the nominal wages of the labourer.

These arguments, while demonstrating the accuracy of my original observation that "It is the *consumers* of *products or services* who would ultimately lose by the advantage gained by the industries whose wages were nominally raised, *and not the capitalists and employers* (as such) *who directly were obliged to advance the nominal wages*," they also form a complete refutation of Mr. Ogilvy's opposing argument, tending to show that "*Every enforced rise of wages will be clear gain to the labourer, because the loss will fall upon the landlord, and stay there.*"

The fact that rent forms no part of the price of agricultural produce may startle many who have not given the matter deep consideration, and although affirmed by me as a truth, it must not be supposed that I take up a singular attitude in respect to this question : for it is the generally accepted opinion of the ablest economists and thinkers of the day. In proof of this I need only cite one witness, Mr. F. A. Walker, whose able work on Political Economy, published in

1887, deals so thoroughly with all vexed questions of this character. At page 200-201 ("Political Economy") he writes:—

"From the law of rent, as it has been stated, we deduce the very important conclusion that rent forms no part of the price of agricultural produce.

"No proposition which the political economist has occasion to announce is so startling, at the first hearing, as this; nor does any other contend against such persistent incredulity. And yet no proposition can be more clearly established."

Notwithstanding what has been said, it is quite possible, and has actually occurred recently to a large extent in England, that a rise of agricultural labourers' wages there, or what has the same effect, the opening up of large areas of more fertile land, as in America, or both together, may have the effect of throwing the poorer lands of any one place out of cultivation, and thus directly diminish the value of rent in that place. This is happening now, and for the last fifteen years in England, mainly by the influx of cheaper products from the distant vast plains of Dakota and other fertile areas of America. But what does this involve? Why, that for every 1,000 acres thrown out of crop cultivation, thereby diminishing rent, about 30 breadwinners, equal to 173 persons, are directly deprived of employment. This is the only way in which rent can be injuriously affected, but it is a process which is equally disastrous to the local agricultural labourer. It is also, on the other hand, advantageous to the consumer so long as these themselves do not form too large an element of the general population; for otherwise their cheapened foods of foreign creation might be more than counterbalanced by their diminished earnings as producers, and thus operate unfavourably upon their *purchasing power* or *real wages*.

But returning to the question of rent and price, it is clear, as affirmed by Mr. F. A. Walker, "That in the same market, at the same time, there is but one price for different equal portions of any (similar description) of commodity;" and "We have also seen that the normal price is fixed by the cost of producing *that portion of the supply* which is produced at the greatest disadvantage. Apply these principles to the case in hand. England does not raise all the wheat needed for the subsistence of her population (mainly mechanical and industrial). Besides cultivating the most fertile of her own fields she makes heavy draughts upon the United States, France, Egypt, Hungary, India, and the Black Sea region. For the wheat of all these countries, however, so far as it is of the same quality, *there is but one price*. That price is fixed by the cost of raising the million, say of bushels, which are raised at the greatest disadvantage, which means at the *greatest distance*, viz., on the plains of Dakota." Wheat may be raised in Middlesex at an actual cost not exceeding two shillings per bushel; but the Middlesex farmer will not, on that account, sell his wheat below the market price, say six shillings (four shillings), which price is fixed, as we have seen, by the wheat from America. The difference, four shillings (two shillings?) is to be profit for somebody; and we will now proceed to show * that this body must be either the landlord or the tenant, not the agricultural labourer, and not the consumer of flour."

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* As he afterwards does—p. 202.

To give a more explicit illustration of the probable effects of an increase in nominal rate of wages and of the process by which any increase in wages must fall upon consumers, and not upon rent of landlord, or the profit of the capitalist or entrepreneur—the following table is drawn up. And to throw further light upon the matter, let the points be discussed as if in diaologue between three persons, representing —landlord, builder and workman.

INCOME AND HOUSE RENT BEFORE AND AFTER A 20 PER CENT. RISE OF WAGES AND COST OF MATERIALS IN BUILDING TRADE.

—	Before Rise.			After Rise.			Amount of Net Increase or Decrease.		Per cent. Net Increase or Decrease.		Percentage.
—	Annual			Annual			Upon Income less Rent.		Upon Income less Rent.		Actual Increase to House Rent.†
	Gross Income	House Rent.	Income less Rent	Gross Income.	House Rent.	Income less Rent.	Increase.	Decrease.	Increase.	Decrease.	
	£	£	£	£	£	£	£	£	P.C.	P.C.	—
Landlord‡	1,000	110	890	1,000	130	870	—	20	—	2·25	18·2
Building Contractor‡	500	85	415	500	100	400	—	15	—	3·0	17·6
Mason*	*125	*35	*90	*150	*40	*110	*20	—	*22·2	—	*14·3
Butcher‡	110	25	85	110	28	82	—	3	—	3·53	12·
Tailor‡	102	20	82	102	22	80	—	2	—	2·44	10·
Labourer‡, (not Builders'.)	90	18	72	90	20	70	—	2	—	2·77	11·1

† The land element of value in house rent is assumed as if not affected by rise in the wages and cost of materials in building trade, and therefore it does not show 20 per cent. increase on gross rental.

* Indicates the effect upon one of those who benefited by the rise in wages.

‡ Indicates the effect upon others.

Let us, then, suppose—as indicated in the preceding table—that all persons whose services are necessary to complete the building of dwelling houses (from the quarryman to the house painter and glazier) succeeded by a strike in having their wages or services raised 20 per cent. The question at issue between Mr. Ogilvy and myself is involved in the query:—Out of whose pockets would this 20 per cent. be derived?

Mr. Ogilvy adopts the view that it would come out of the pocket of the *capitalist* or *employer*; and I from a considerable practical experience in the building and letting of houses, gained during five years in a large city, affirm that it comes out of neither *employers nor wage-earners* as such, but out of the pockets of all persons who inhabit houses, *i e.*, the *consumers* of houses so to speak. For let us take an instance of the process whereby the 20 per cent. increase ultimately comes to fall upon the *consumers of houses*, whether rich or poor, employer or employed, as it is attempted to be shown in the following imaginary dialogue between the three persons already referred to.

DIALOGUE BETWEEN LANDLORD AND BUILDER.

A.—*Capitalist*, a landlord of houses, deriving his income from investing his money in houses.

B.—*Employer*, a building contractor, who derives his income from his capital and plant and his directing skill as a builder and organiser.

A.—My dear *B*, I propose to build four additional dwelling-houses, similar to the four which you built for me for £1,600 two years ago: 1 at £500, 2 at £400, and 1 at £300; and I shall be obliged if you will give me an estimate of what you will now build four similar houses for me in the same locality.

B.—I shall be happy to do so, but you must be prepared to pay a higher price, as all building trade wages and materials have now gone up 20 per cent.

A.—What? Do you mean to infer that I can afford to pay the extra 20 per cent. out of my pocket when my average profit hitherto at the old rates only yields me 5 per cent. on capital outlay in buildings, repairs, taxes and other necessary expenses in connection with letting, etc.? It is impossible!

B.—Well, there is no help for it. If you won't build others will; for as the population increase is not likely to be greatly affected for any length of time by the rise in the wages and materials of the building trade, more houses must be built by some one or other.

A.—That is all very true, but how can landlords afford to build houses at such prices at the old scale of rental?

B.—Rental of buildings, not land rent, in all times and places, you are surely well enough aware, is determined by current rates and prices of land, labour, and materials, and not upon old rates of rental. You are no more called upon to let your houses at the old rates of rental than I am to contract for the building of houses at the old contract prices. In my profession we base our estimates of costs, not upon the old rates, but upon what we infer the rates of wages, money, and materials will be on the average during the *time* and at the *place* where the new contract is to be carried out; and if you are to survive as a successful landlord you will have to be guided by the same unavoidable commercial principles.

A.—But that would only be done by making a corresponding increase in the rents of houses?

B.—Certainly. If competition hitherto among landlords obliged them to restrict their profits to 5 per cent. on capital outlay, the altered conditions of the labour market ***affect them all alike***, so that all who do not become bankrupt must earn the same profit which competition among landlords themselves determined as a safe working minimum profit long before the recent rise of wages and materials came about. That means that rental of houses must bear the extra cost of building. Rents must be raised. The occupiers of houses must inevitably bear the burden of the increase, and as both you and I occupy houses we must also pay additional rent as occupiers of houses. But although we do expend more of our income as occupiers (*i.e.*, consumers) of houses, that cannot affect our income as derived from our business concerns as landlord and builder.

A.—Why so?

B.—Because the profits of either are determined, not by the wages, high or low, paid to workmen under them, ***so long as they are general***, but upon the intensity of competition between employer and capitalist, and other employers or capitalists in the same business.

A.—But the workmen think that their higher rate of wages comes out of the "Wages Fund" of the older economists, and this is one of the reasons why they are so bitter against the employers or capitalists for absorbing, as they think, a too great share of the joint produce of labour and capital.

B.—The older economists are largely to blame for the present hostile attitude between the employer and his workmen; for undoubtedly this attitude is, in a great measure, based upon the mistaken notion that the increase in wages is an encroachment upon the employer's share of profit; whereas it is in reality an additional charge on the values of products affected, which is ultimately borne by the ***consumers*** of the particular products.

A.—But will the workmen be satisfied if they comprehend this matter in the light in which you regard it.

B.—Why should they complain? They have got their 20 per cent. increase. But if you are anxious to ascertain their views let us put the matter to the test by asking Jones the

Hewer, one of the most intelligent of my workmen, who is now approaching us.

A.—Good-day, Jones, I suppose you feel satisfied with the results of your strike contest, which has terminated so favourably for the workmen in your trade.

Jones.—Ah, sir! we are glad to have scored a success, but it has been at a bitter cost to all of us.

A.—But surely with 20 per cent. increase to your wages you ought to be fairly well satisfied.

Jones.—Oh, that's true enough, so far as the rate of wages is concerned, but trade is now in a very depressed state, and as a consequence many of our brother workmen are but half employed, and even if we were all fully employed at the better wages now ruling it would take fully ten months to cover our losses due to enforced idleness during the long bitter strike of nine weeks, which brought us all so much distress and misery.

A.—Ten months do you say?

Jones.—Yes, fully that, without mentioning the increased cost of living, now that the landlords are about to raise our rents by about £6 a year.

A.—I should like to hear how you account for your loss being so great that it should take so long a time at the present higher wages to cover it.

Jones—Oh, that's easily proved. Our nine weeks' idleness caused us a direct loss of £20 12s. 6d., reckoned at our old rate of 8s. 4d. a day, for 44 hours in the week. Our present wages are higher by 1s. 8d. a day (*viz.* 10s.), and it is easily reckoned that it will take 247½ days of that increase to make it good; and as we can only reckon 300 working days in the year it means the better part of ten months' earnings to put us straight.

A.—How do you account for so many of your men being still only half employed?

Jones.—Well, you see, the higher rents asked for the better class of houses are driving the poorer classes into the inferior houses that were formerly empty, and there is less demand than usual for new houses in consequence.

B.—Jones is quite correct there, as I know to my cost; for I have not had a third of the contracts this year, as compared with the average of the last three years, and my experience is also the experience of other builder contractors. But in my opinion there is another reason for the present slackness in the building trade.

A.—And what is that?

B.—I have long observed that statisticians are quite right in their statement that a sudden increase, however caused, in the cost of living, has an immediate effect in checking, or, rather, postponing marriages; and in no trade has this effect so immediately a depressing influence as upon the building trade.

A.—But things will take their natural course in time.

B.—True, but in the meantime our trade, whether for workmen or employers, suffers, and, as Jones has said, it will take a long time for the better state of things, when they do come about, to make good the losses of the present year of enforced idleness and its evil consequences to both employers and workmen. Employers now see, when it is too late, that it would have been better for employers and workmen had they approached each other at the outset of the strike in a more friendly way, instead of fighting it out to the bitter end of a nine weeks' struggle.

Jones.—I say aye to that, too.

A.—Then you, Jones, also think it was a mistake to enter upon this strike without a serious attempt to gain your cause by a more reasonable course?

Jones.—Aye, sir, I do, and I have always been of the opinion that it would have been better to have settled our dispute by a friendly conference, even if it were to end in a compromise, rather than strike first and be obliged to confer when we were embittered by a long and cruel struggle for victory.

A.—And why, then, was the strike originated so suddenly without an earnest attempt to settle matters by a friendly council of conciliation?

Jones.—Why? You well enough know that the thoughtless, and those not burdened with the cares of a family, form the majority of workmen, and these are always too eager to enter a conflict without counting the bitter cost.

B.—The workmen are not singular in this respect, for the majority of employers at the outset were also too anxious to precipitate a conflict without proper consideration, and are also much to blame in their eagerness to fight out the struggle rather than compromise or make any honest attempt to approach the settlement of differences of opinion by conciliatory conferences. I, too, am comforted with the feeling that, although one of the minority of my class, I used all the influence I could exert to promote a friendly conference at the first; but, as in Jones' experience, I and those who acted with me were over-ruled by the majority, who were too eager for conflict to give the matter the consideration that was necessary.

A.—Then both of you think that the strike might have been avoided with advantage to all?

B.—Yes, I think so. We could have arrived at the same result had we discussed the matter fairly at the outset.

Jones.—I am sure we could if the same arguments on both sides were considered at the beginning of the dispute, and if we had an opportunity to discuss on even terms our misunderstandings of each other.

A.—Then both of you are of opinion that all future struggles of this kind in the various industries will be settled by friendly conferences rather than by lockouts or strikes.

B.—I fear not. The majority of men only see that the strike effected a rise of wages; and that will induce other trades to follow their evil example. The misery of the thing they do not consider. Nor do they perceive that the raising of wages if made general would cancel all the advantages gained by the first few industries who reaped the advantages of the wages increase; for the nominal increase in cost of living would then actually counteract all the advantages obtained by nominal increases to income.

A.—You have stated that before, but I confess I do not quite see how such a result comes about.

B.—It is, however, a matter the truth of which can easily be demonstrated by a simple process of reasoning, and I will try to make it clear to you. First let me assume, according to the modern course of exchange, that no element of the gratuitous gifts of nature, as such, enters into nominal values of products, and therefore the final nominal cost of all products and marketable satisfactions to consumers is solely determined or made up from the aggregate nominal cost of all the services engaged in the work of producing them. In this way it is obvious that the aggregate nominal value of all *wealth in exchange* or satisfactions would be exactly identical in nominal value to the nominal earnings of all persons engaged in producing them, whatever the nature of the services may be; whether organising and directing skill, wealth producing instruments, or the simple physical power of human bone or muscle. Any addition, therefore, to the nominal cost of production must correspondingly increase the aggregate nominal cost of products.

A.—I can follow you so far, although I confess I am not able to see as yet why the gratuitous gifts of nature should not be monopolised by some, and in this way come to be a charge upon products to consumers, without forming an item of expenditure of energy or capital on the part of the producer.

B.—Your observation is a very important one; for although upon another occasion I may discuss this point with you, I must ask you for the present to take it for granted, as an assumption on my part, the truth of which may afterwards be discussed on its own merits.*

A.—Well, let us for the present admit this important assumption on your part, it still remains to be proved that no benefits would accrue to wage-earners if the nominal incomes of all the services of breadwinners, were equally increased.

B.—Yes, that is the point I desire to prove. But you must also bear in mind that it is the mere raising of the nominal rates of wages or incomes I refer to; for if by raising the rate of wages we could also correspondingly increase the number or actual quantity of products, my argument would completely fall to the ground.

A.—Yes, I perceive this, but I cannot myself see any indication of increased energy on the part of the great body of workmen who have had their wages raised.

B.—I am glad you admit this, for I can assure that so far as my business is concerned the amount of work performed per hour per man upon the whole remains unchanged.

A.—May not, however, the indirect effects of the improved condition of your workmen—giving them greater opportunities for self-improvement and greater power to improve the education of their children—result indirectly in promoting the spread of a higher culture and intelligence, and by this means increase the agencies at work which promote invention and discovery, and so multiply man's power over natural forces. For if this should be the outcome, our experience in the past shows that the satisfactions of life might be increased indefinitely without an additional tax upon the labourer's physical efforts or time, and without a very much larger expenditure of his income towards labour-saving instruments.

B.—I do not deny that something of this may be expected, providing the rise in wages is not general; but under any circumstances it must be infinitesimal; for *invention and discovery* spring from the *individual mind*, and have very little to do with the material condition of the individual, or a more comfortable state of life. The phrase, "Necessity is the mother of invention," has not come to be quoted as a world-wide phrase without some broad show of reason and truth; and this certainly does not encourage us in expecting a larger crop of inventors or discoverers from those whose condition has become more comfortable.

A.—This may be true, but surely you must admit that a greater spread of intelligence must broaden the sources from which inventive genius springs.

B.—Again, I repeat that I do not deny that this may have some influence; but I fear the mere attainment of a more

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*See *Monopoly of the Gifts of Nature* ("Root Matters"—First series, pp. 31, 32).

comfortable state of existence among a section of our industrial classes would in itself have an infinitesimal influence upon invention, discovery, and increased energy. The new idea springs from the single mind, and not from the society or aggregate.

> " Men perished in winter winds till *one* smote fire . . .
> They gorged on flesh tell *one* sowed corn . . .
> They mowed and babbled till some tongue struck speech.
> What good gift have my brothers, but it came from
> Search, and strife, and loving sacrifice."

Professor Hearn had a clear perception of the conditions which determine invention when he wrote the following words :— *

"At every time and in every place the master of all arts and the bounteous bestower of genius is Want. It quickens the perception and sharpens the power of contrivance. This action is felt in every part of industry. There is scarcely one of the great improvements in the arts which has not immediately been connected with the expansion of some want. The want may be caused by the natural development of the capacities of the person by whom it is felt, or by the presence of some external obstacle. But whatever may be its origin, or whatever form it may assume, there is always a want, and a want of considerable persistence and intensity."

It was to strikes among workmen and the dearness or scarcity of skilled labour in America and in other countries that we mainly owe the origin of many ingenious labour-saving instruments, such as the cotton gin, the reaper and binder, and sewing machines. It was the craving for more leisure to play or scrog which led the boy Humphrey Potter to discover the first method for making the steam engine self-acting.

A.—It seems to me that the logic of your argument is to undervalue the results arising from improvements in the material condition of the people, and to magnify the influence of difficulties, obstacles, and want.

B.—You are no doubt in one sense justified in making this observation; but remember it is restricted by me to the following questions:—What are the potent influences in promoting useful invention or discovery? Do they spring more freely from men's minds when their material conditions are improved, or are they originated more frequently under the pressure of wants and difficulties. My own opinion tends to the conviction that the latter are the more potent influences.

In closing this imaginary dialogue, which might be greatly extended with advantage, let me now touch upon the question raised by Mr. Ogilvy as regards the relative personal consumption of wealth by rich and poor respectively.

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* P. 194. Plutology.—Extent of Invention—Circumstances which determine it.

PERSONAL CONSUMPTION OF COMMODITIES BY THE RICH.

It is evident that Mr. Ogilvy had not bestowed his usual care upon the question concerning commodities consumed respectively by rich and poor, whether luxuries or necessaries. He has taken a very strange course in forming an opinion of the relative amount of consumption of goods by rich and poor from a superficial impression made on his mind by the showy displays seen in shop windows.

Rich articles are more fitted for attractive display as advertisments, but only the inattentive, or the unskilled, would ever dream of estimating, upon such evidence, the relative quantities and the relative aggregate values of goods held in stock for sale intended for the rich and poor respectively.

Although the gorgeous silks, satins, velvets, ribbons, and dress goods form the chief displays in the windows of establishments devoted to the sale of textile fabrics generally, they certainly form an infinitesimal part of the value, and a still more infinitesimal part of the weight of the general stock on shelves and in warehouses. This stands to reason; for it is well ascertained that all persons receiving upwards of £150 per annum—*i.e.*, under the annual average income of the skilled mechanic—only form about 2·28 per cent of the total population even in rich England. But a better plan would be to ascertain the value of these luxurious silks, satins, etc., as determined by the imports of a country whose principal supplies of textile fabrics come from foreign sources. Victoria is such a country, and an analysis of that colony's imports shows that scarcely 7 per cent. of the value of textile fabrics and dress are represented by the richer articles, such as silks, satins, ribbons, velvets, dress goods, and scarcely 1 per cent. of the weight of materials.

As regards *Food*, certainly not more than 5 per cent. can be set down as consumed by the rich personally, although their expenditure would be a little more than this if the consumption of their boarded servants were by error allowed to be included.

As regards *Luxuries*, again, it is remarkable that although we gave to all persons over £150 income the whole of luxurious articles imported represented by works of art, paintings, musical instruments, jewellery, and plated-ware, etc., it would not represent more than 7 per cent. of what the masses alone consume of *luxuries*, in the shape of drink and tobacco.

Again, as regards the consumption of the fruits of labour connected with the building trades, it is well to bear in mind that 64 per cent. of the value and 92 per cent. of the number of all *dwelling houses* in Great Britain are connected with those (certainly not the rich) living in houses under £30 annual rental.

Although the nominal incomes of the rich appear to absorb a far greater proportion of the aggregate nominal earnings than their proportional numbers as units of the population, yet it must be borne in mind that a reference to the mere nominal incomes is a most deceptive guide as regards the individual consumption of the rich; for in the latter are aggregated much of the incomes of vast numbers of professional classes and domestic servants, which, being reckoned again and again as distinct incomes, although derived chiefly from the expenditure of the rich, make the nominal aggregate of the income of the rich and of total income enormously above the true net income of both the rich and the national aggregate. That is, the real incomes of *individuals* are counted over and over again, and thus falsify the true proportions of net personal income coming to rich and poor respectively.

In opposition to Mr. Ogilvy's statement, then, I may confidently repeat part of what I have already dealt with more fully in a former chapter of "Root Matters in Social and Economic Problems" regarding

Distribution and Consumption of Wealth.

Under this heading I have observed, "There are many fallacies current with respect to the creation and distribution of wealth. If all the enormous wealth year by year created by (1), stored fruits of previous labour (Capital—of which steam engines alone represent approximately the work of 1,000,000,000 men, or more than the physical energy devoted to the creation of fresh wealth, than double the working population of the earth), (2), current labour, and (3), the gratuitous forces of nature, were directly devoted to consumption or enjoyment, no doubt the proportion per head alloted to the industrial labourer would be small indeed in comparison with the rich."

But the human body, whether rich or poor, can only consume or assimilate a certain quantity of food per day. The old, sickly, and very young, cannot consume or assimilate as much as the strong healthy persons of youth and prime of life. Health and hard physical labour cause the body to burn more food, and the greater tear and waste consumes more weight of the products of the sheep and cotton plant just for the same reason as greater energy exhausted by a steam engine demands a much higher consumption of fuel and a much greater waste of parts in tear and wear.

From this reasoning it is almost conclusive that a strong healthy navvy can and does consume more weight of the products of the soil, of the flour mill and the weaver's loom, than the less robust city clerk or the brain worried financier; the mere quality or rarity of the materials involving more cost in some of the materials of the rich is comparatively insignificant and involves no more tax on the soil, on the capitalist's machines, nor on the workman's labour.

Further, it can be shown that if the steam engines alone of the capitalist perform more work than twice the number of the whole working population of the earth, and if these only form a part of his machinery, tools, and instruments, known vaguely or concealed under nominal values as "capital," it follows that the rich capitalist, or organising entrepreneur, cannot or does not abstract from his profits the same proportion of his income towards his personal wants and enjoyments as the workman does. On the contrary, what he can directly consume personally of the primary satisfactions which make up the bulk of consumable wealth is limited by the same natural laws as the humblest workman; and the necessities of repairing the tear and wear of his costly machines (real capital) or the passion or necessity to increase the number and power of his machines, and to protect and keep them ever at work, abstract the greater portion of his increasing or decreasing profits, which the thoughtless imagine are absorbed altogether in personal consumption.

What is usually termed "The enormous accumulations of wealth in our times," "The riches of capitalists," do not consist of fine houses, luxurious equipages, money or grand parks, or if so, it only forms a most insignificant portion of it. The great bulk of the nominal and real wealth of capitalists consists of land improvements, mines, railways, tramways, ships, canals, stores, warehouses, manufactories, machines, tools and instruments, etc., themselves; and though rightly included in the aggregate wealth of a country by statisticians, these do not in any sense enter into the *personal consumption* of the rich owner any more than they enter into the personal consumption of the workman engaged in connection with these forms of national wealth.

THE FRUITS OF LABOUR.

Familiar phrases, such as "The fruits of labour," "The toiling masses," "Man shall live by the sweat of his brow," "Capital is the fruit of labour," and such like, though correct enough as pleasing figures of speech, are too often wrested from their proper uses to adorn the fallacious arguments or rhetorical displays of well meaning, kind hearted people, in whom the logical faculty too often is easily overborne by sentiment. Although I have a high appreciation of Mr. Ogilvy's logical acumen, I cannot help feeling that his enthusiasm and kind heart have, for the moment, dominated over his logical faculties when he spoke "of the lower ten millions whose toil is the *active factor that produces all wealth*, not of the upper ten thousand who *in some mysterious way* manage to get rich upon that toil." I am not disposed to quarrel with these words in so far as they convey the idea that their services (whether functional as accumulators of capital energy, or organising energy as entrepreneurs—man for man), absorb a very much larger share of the aggregate satisfactions produced than is ideally just or desirable. But this objection is merely one of degree, and is applicable to all persons between the earnings of the poor city girl of London, who has to wearily "stich, stitch!" for dear life for 1s. a day, and the colossal earnings of a Vanderbilt. The following table may help to convey an idea how far *privilege* permeates throughout the whole range of human services, so far as *reward* bears any relation to either *time* or the amount of *muscular* energy expended:—

EARNINGS.

—	Average per day.		Per cent. Increase.	Average of Rich and Poor per day.			
				Above.		Below.	
	s.	d.		s.	d.	s.	d.
1. London Seamstress	1	0	—	—		4	6
2. English Agricultural Labourer...	2	0	100	—		3	6
3. Australian Labourer	6	0	200	0	6	—	
4. Australian Carpenter	12	0	100	6	6	—	
5. Average of the Rich Classes in England 3·3 per cent	40	0	233	35	6	—	
6. Average of Rich and Poor ...	5	6	—	—		—	

This proves that the total income of rich and poor—in one of the richest countries of the world (United Kingdom, £1,250,000,000)—only averages 5s. 6d. per day per breadwinner, and that all those who earn over that rate per day really belong to the "privileged classes;" for even the common labourer of Australia at 6s. per day receives 9 per cent. above the *level of equality*, which, if once attained, so many vainly dream would procure them a vast addition to their present allotted share in the distribution of wealth. The Australasian carpenter actually receives a higher relative rate of income (not a greater absolute difference, however,) above the London seamstress (viz., 1100 per cent.) than is the average rate of the rich (3·3 per cent of population) above that of the Australasian carpenter—being only 233 per cent. higher.

It follows clearly from this that strikes for higher wages among those who already earn above the *standard level* of 5s. 6d. per day cannot justify their claims by the appeal indicated by Mr. Ogilvy that it "is a movement of the underpaid against the overpaid." It is not a fact. So far as the majority is concerned, it really would be a *movement of the overpaid against the underpaid*, or more specifically, it would be a movement of the lower grade of the privileged classes against the masses forming the unprivileged, *i.e.*, all those whose earnings are now below 5s. 6d. a day, or the standard level of equality. Nor can the lower grade of the privileged classes contend with justice that their higher wages are in proportion to greater expenditure of *time or muscular energy.* On the contrary it can be easily demonstrated that the lowly paid agricultural labourer or common lumper expends far more of his time and muscular energy than the better-paid carpenter, engine fitter, or mason.

ACTIVE AGENTS IN THE PRODUCTION OF WEALTH.

Finally let us examine what truth there may be in Mr. Ogilvy's statement in which he leads us to infer that the "toil" of "the masses," "the lower 10 millions," alone "*is the active factor that produces all wealth.*" Entertaining such a view, it is not remarkable that Mr. Ogilvy should regard the riches of the "upper 10 thousand" as a hoard mysteriously and wrongfully abstracted from the forces actively engaged in producing wealth.

If by the toil of the masses he means that *all the physical forces* requisite to transport and transform natural materials to suit the needs of man, he is manifestly wrong. For (exclusive of the more gratuitous forces of nature, such as natural chemical changes, multiplication by the mysterious forces of life, sunlight and heat forces, gravitation, the rain, dew and the fertile soils, and the animal, vegetable, and mineral products in their natural state and position) there are the active forces set in motion—not of the expenditure of muscular energy—but of mental and moral force, exerted by men of forethought, of skill, of invention, and of the provident who designedly saved from immediate personal consumption and devoted such savings purposely to the construction of mechanical and other aids, devised or discovered by skilled minds, whereby the *forces of nature*, such as gravitation, chemistry, steam, water, wind, electricity, leverage, lower animals are so captured, tamed, and drilled, that they now exert a physical force in the production of man's wealth—whether in the way of transporting from place to place, or in transforming materials from the natural raw state to the highly finished—compared with which the *brute* *or muscular force* actually exerted by all the working men of the globe forms the most insignificant fraction.

I have already pointed out that it is estimated that the steam engines alone now engaged actively in the production of man's real and nominal wealth represent double the *potential muscular force of all men in the world* at the present time, exceeding the *muscular force of men actually engaged* in the production of man's wealth by, perhaps, three or four times. The mere muscular pressure of a man, which, on his part, only exhausts his muscular energy by what would be equivalent to the movement of his body by one step, may, and in fact now incessantly does liberate and set in motion a transporting force in one machine equal to the combined total muscular force of from 200,000 to 500,000 men.

At the present moment on the railways of Pennsylvania, in America, *a single engine* conveys a load of 1,500 tons 29,927 miles in one year. It would, in a primitive stage, say by the strong African carriers of Stanley, take the mere muscular force of 465,360 men, carrying 60lb., and travelling at the rate of 12 miles per day, to accomplish the same work in the same time; and even though they only received wages at the rate of 1s. per day, it would cost £6,980,400; at 5s. per day it would cost £34,902,000. The single Pennsylvanian engine, however, carries the same load, viz., 1,500 tons, 29,927 miles within one year for the sum of £92,721, or $\frac{1}{2}$d. per ton per mile. That is, a single modern locomotive exerts as much wealth-producing energy as could be effected by the whole muscular force of 465,360 strong men, and at $\frac{1}{376}$ of the nominal cost. Even if we went into refinements, and attempted to abstract the human *muscular energy* expended in the manufacture of the engine from raw materials, and the consumption of stores and materials consumed in the work, also partly the produce of the muscular force of man, it would be more than covered by the subtraction of the muscular energy of 600 men, leaving still to the credit of the single machine a balance of natural physical wealth-producing energy, *i.e.*, *non-muscular*, equivalent to the *muscular* energy expended of 464,960 powerful men during one year.

When in addition we think of the Spinning Jenny, the electric telegraph, the sewing machine, and the thousand complicated forms of machinery—such as the Naismith Polka Hammer, which by the slight pressure upon a handle a small boy can instantaneously pour 100 ton blows upon ductile masses of iron—we can have some faint conception of the immense mechanical and natural forces ever at work in civilised countries—outside of the muscular force exerted by man—and contributing its giant share of the physical agencies which give commercial value to man's wealth.* It is clear therefore that nothing can be further from the truth than the assumption by Mr. Ogilvy that the energy of "the lower ten millions" or the "masses" alone represent the active factor that produces all wealth.

The brains of man can alone be credited with invention and discovery, not his muscular power. It is to the accumulations of savings from personal consumption by the labourers of former times that we are indebted for the stores devoted to the construction of the powerful mechanical and other auxiliaries now engaged in aiding the current labour of men, and not, as falsely assumed, to the mere energy exerted by those who happen to be the labourers or workmen of the present moment.

The large body of the capitalists of to-day are, broadly speaking, really the natural descendants and inheritors of the *savings* of former workmen, who not merely *worked* but *saved;* and it is specially because of the *savings* of former workers that we have now a vast accumulation of *capital* invested in labour-saving appliances, and in works of permanent utility to all men, and not generally because those who *saved* were indebted to labour for their savings. All labourers in the past, as well as in the present, did or do not accumulate savings, and the descendants of those *who did not save* have no just claim to the capital or accumulated savings now largely in the possession of those who saved, or their natural descendants.

Of course the children of the former savers of capital are thereby now often raised above the social scale of their fathers. But this is natural; for it must not be forgotten that the affection and solicitude of parents for their children are ever the active motive forces which induce parents to sacrifice present personal gratification, and to save up in order that their children may enjoy a larger amount of the world's material satisfactions than their parents permitted themselves to afford out of the fruit of their own labours. Take away this powerful motive and you destroy the main source of the savings which make capital accumulation a possibility. Capital wealth, therefore, has not been wrongly abstracted from the labourer as such. It is a real addition to the world's power and wealth, solely built out of the savings of those who providently abstained from consuming at the time the whole of the fruits of the labour to which they were entitled, which otherwise would have been as much lost to the world as if it had been destroyed by fire.

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* See also p. 40-44 Root Problems, 1st series, which also demonstrates that "Improvement in the Condition of the Individual is largely due to the Savings of Anterior Labour (capital) skilfully applied as instruments aiding Production."

It is not because *nominal wages* are much higher to-day in Australasia than at the close of the sixteenth century in Europe that the present workman is so much better off in every way than his predecessor of three hundred years ago, but mainly because of the great increase of capital wealth invested in labour-saving appliances, whereby the annual wealth created for consumption and *real wages* or purchasing-power over wealth have so improved that the workman of Australia can, by the expenditure of 4½ days' labour, command a much larger share of the world's wealth or satisfactions than could be done by the accumulated savings of 40¼ days' labour amidst the dirt, discomfort, and almost enslaved condition of the labourer 300 years ago.

I think Mr. Ogilvy's objections to my former paper on strikes have been shown by these observations to be based upon assumptions which cannot be sustained when subjected to close scrutiny, and I can only re-affirm that it is by increase of *savings* properly applied in the creation of instruments which will still more greatly multiply the powers of man that any marked improvement to the condition of the masses can be successful. Without this the mere raising of wages can only benefit a few industries at the expense of the many.

DISCUSSION.

Mr. Ogilvy said that Mr. Johnston had rather drifted into the ethics of the question, which were expressly excluded in his paper, and discussion confined to the question whether strikes, as a matter of fact, really improved the condition of the masses. He had tried to show that they did, and Mr. Johnston had tried to show that they did not. It was for the members to judge. Mr. Johnston had based his argument principally on the theory of Ricardo, but he differed with him in thinking that that authority had expressed the whole theory of rent. Although later economists had adopted it, the British Parliament had virtually repudiated the theory by the establishment of Land Courts in the Highlands of Scotland, and in Ireland, thus introducing an artificial element into what was held by some economists to be a natural law. In regard to what Mr. Johnston said about the rent forming a part of the price of agricultural produce, there were some farmers present, and he asked them if they had to pay twice as much as they now did for their labour could they afford to pay as much rent?

Mr. W. E. Shoobridge said that there were two points which occurred to his mind. One was that the actual amount of wages was not so much the question as that of facility of exchange. Mr. Johnston had pointed out in his original paper, and he agreed with him, that it was not the actual amount of wages paid that benefited the workman, but the satisfactions that could be procured by the results of the labour of the workman. Mr. Johnston had shown what was an undoubted fact, that owing to increased production the working man was able now to get better satisfaction of his wants with his wages than was the case a few years ago. He attributed the origin of strikes to the combination in the first place of capital, which ruled prices. Of late years, through the improved condition of labour, some of the labourers had been able to make savings which accumulated so that they could do for a certain time without actual labour. They were, therefore, to a certain extent capitalists, and by combining they had been able to demand their own terms. He thought that this was the secret of the source and success of all strikes. There was no question but that the product of individual labour had greatly increased, but the question was how this increased product was to be divided if it was the case that, owing to the combination of capital, the amount paid by the consumer was too great in proportion to the amount paid to the labourer. This was a difficult question, but he hoped that it would be settled in the future without resorting to such barbarous methods as strikes. He considered that the main question at issue was whether it was possible by the present appliances to produce a great deal more of the articles necessary for life and comfort than was produced previously; if so, by labourers having the means of getting a larger share in the products their condition would undoubtedly be improved.

NOTES ON A NEW TASMANIAN PLANT OF THE ORDER BURMANNIACEÆ.

By Baron Ferd. Von Mueller, K.C.M.G., M.D., Ph.D., F.R.S.

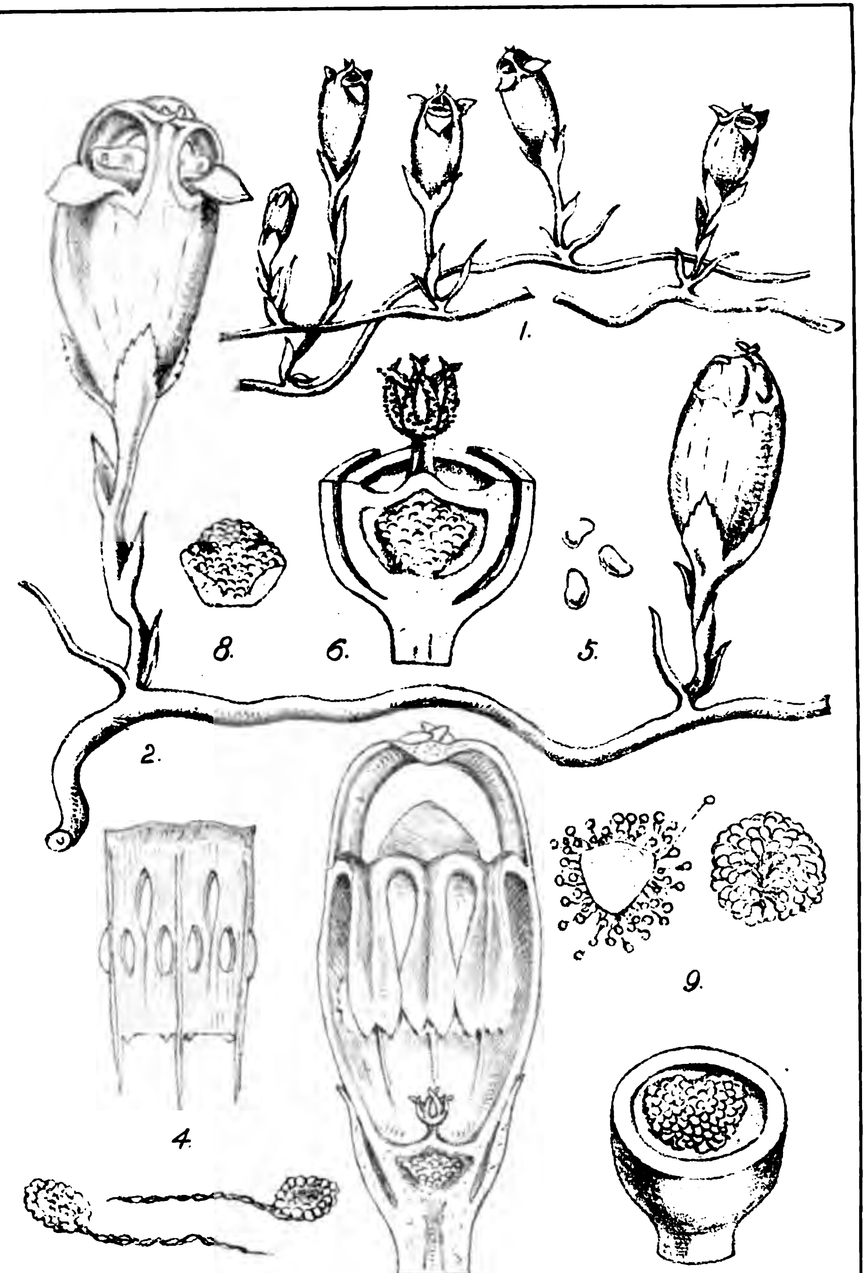
In the early part of November 1890 my attention was directed, by a letter from Mr. L. Rodway, of Hobart, to his discovery of a remarkable plant, parasitic on the extreme roots of Aster argophyllus, and from his notes it was evident that this plant would at all events be new for the records of the indigenous vegetation of Tasmania. But as the plant was of fugitive growth and deliquescent structure, no specimens were in the first instance secured or preserved. On my particular request the search was very patiently renewed with the result of one more specimen being procured, well developed, and another bearing an unexpanded flower. These arrived in a good state of preservation, being carefully packed between the fresh leaves of some tender grass. Much to my astonishment I perceived that this long hidden floral treasure was a species of Thismia, of which genus (in its widest sense) as yet some few species are known from southern continental Asia, Ceylon, the Sunda-Islands, New Guinea and tropical South America. On careful dissection the Tasmanian congener proved very distinct from all others. Thus, then, we became suddenly acquainted with a member of this otherwise intra-tropical genus from the remotest southern part of the Australian dominions, from whence indeed this would have been least expected; nevertheless, the order of Burmanniaceæ is represented by one species of the typical genus, namely Burmannia disticha, down to a very far southern position in New South Wales, and also just outside the tropics from Nepal, while another, B. biflora, advances northward to Virginia, and a species of Apteria, A. setacea, gains its northern boundary in Florida.

Before offering any further general observations, I shall detail descriptively the characteristics of the co-ordinal Tasmanian plant.

Thismia Rodwayi.

(Bagnisia Rodwayi, F.v.M., m.s.c.)

Stem to about two inches long, flexuous, colourless, like all other parts of the plant glabrous; leaves scattered, rudimentary bractlike, semilanceolar, acuminate, devoid of colour; flower solitary, terminal, of putrid odour, closely supported by a much shorter involucre of three appressed equidistant semilanceolar bracts; calyx about ⅔ inch long, somewhat



T.M F.V.M direxit R. Graff. del.

Thismia (Bagnisia)- Rodwayi. F.V.M

1.... Plant, natural size.

2.... Plant, enlarged size.

3.... Longitudinal Section of a flower.

4.... Part of the Staminal column, reversed.

5.... Pollen grains, very much enlarged.

6.... Longitudinal section of a young fruit.

7.... Transverse section of a young fruit.

8.... Placentaries & ovules, the funicles concealed.

9.... Front & Back view of ovules & funicles.

10.... Young Seeds with funicles.

"Mercury" litho.

succulent, ovate-campanulate, flesh-coloured, streaked by six stronger and six fainter longitudinal colourations; its six lobes much shorter than the tube, three semilanceolar-deltoid, spreading, much the shortest; three opposite to the bracts, nearly ovate-cuneate, converging, at the summit overlapping and there connate, keeled by a broadish, flattened, slightly excurrent midline; stamens six, opposite to the calyx-lobes; filaments broad, from the place of affixion near the summit of the calyx-tube slightly ascending, there dark-red and somewhat channelled; thence suddenly bent downward inside the calyx and connate; continued beyond the anthers into a dilated membraneous bidenticulated appendage; anthers pale, their two cells parallel, ellipsoid, slightly distant from each other, longitudinally dehiscent; style short, whitish, thinly cylindrical; stigmas three, colourless, short-bifid; ovulary adnate to the base of the calyx, one-celled, devoid of colour, almost hemispheric, excavatedly depressed at the surface; placentaries three, nearly cordate; ovules very numerous, on conspicuous funicles arising from the whole face of the placentary, provided around with an ample laxe pellucid integument of equal breadth. Complete roots and ripe fruit not yet obtained. In examining the quickly perishable and scanty material, I missed ascertaining the form of the pollen-grains, also determining the relative outer and inner position of the calyx-lobes, regarding which Miers however offers observations on Myostoma already. The rootlet, on which the plant grew bear many pyriform small carnulent short-stalked bodies, somewhat hollow.

That so remarkable, and to some extent also showy plant should have evaded hitherto observation, although since almost nearly 100 years the region about the estuary of the Derwent has been searched for plants, finds perhaps its explanation in the fact, that in all likelihood the flower only is peeping above the soil between decaying foliage, and thus might be easily taken for a young Aseroe or some other fungus, especially as the smell would lead also to that conclusion. Furthermore, each flower must be very ephemerous and perishable, and falls probably also quickly to the prey of various insects, attracted by the odour. Even in Europe the Epipogum Gmelini is often overlooked, when it merely emerges among rotten Fagus-leaves, particularly as the flowers are not high-coloured.

After now, through Mr. Rodway's circumspectness, the Tasmanian Thismia became not only known, but also its manner of growth elucidated, it will likely be found in other places of the island there, perhaps also in New Zealand and in Continental Australia. It should further be ascertained, whether it lives exclusively on the roots of the Musk-Aster, or whether it is nourished also by the roots of any other plants.

How restricted some parasites are in this respect is demonstrated in Tasmania and Victoria by the Cyttaria Gunnii, which never occurs on any other tree than Fagus Cunninghami, all other Cyttarias occurring also only on Beech-trees.

For Australian phytogeography the finding of a Thismia, not as might have been looked for in North-Eastern Australia, but in such an extreme extratropic isolation, is one of the most remarkable additions to our recent knowledge in this direction. But the discovery of this plant is also in other respects of special interest, because it shows that the genera Geomitra and Bagnisia should be united with Thismia, the merging of Geomitra into Bagnisia having already (1883) been advised by Bentham and Hooker, a view acted on by Engler in the "Pflanzen-Familien," 21 Lief. p. 48 (1888). Those who prefer smaller genera for systematic arrangements against more natural and more easily employed larger genera with subdivisions, might assign to our new plant even generic rank, then as Rodwaya, but such a separation would mainly rest on the reduction of three of the calyx-lobes to extreme minuteness, and on the coalescence of the tips of the longer calyx-lobes somewhat in the manner of the Southwellias within the otherwise far disallied genus Sterculia; in typical Thismia the lobes are perfectly disunited, much differing as regards form in various species, while in Bagnisia and Geomitra they are variously united. Adopting all these plants for one generic group, we would obtain chiefly chronologically the following arrangement, so far as the species are hitherto known; but their series will likely in the course of time receive considerable augmentation yet.

1. *Thismia Brunoniana;* Griffith in the transact. of the Linnean Soc. xix., 341-344 t. 39 (1844). Tenasserim.

2. *Thismia Gardneriana;* J. Hooker in Thwaites enum. plant. Zeylan. 325 (1864). Ceylon.

3. *Thismia Macahensis;* Bentham and J. Hooker, gen. plant. iii., 459 (1883) implied.

   Ophiomeris Macahensis; Miers in transact. Linn. Soc. xx., 374-379, t. 15 (1847). Rio de Janeiro.

   This and the closely allied O. Ignassuensis (Miers l.c.) have an obliquely bulging calyx, free stamens, bicaudulate-filaments and upwards converging anther-cells, so that the genus Ophiomeris, against the views of B. and H. might perhaps be kept up.

4. *Thismia hyalina;* Bentham and J. Hooker, gen. plant. iii., 459 (1883) implied.

   Myostoma hyalinum; Miers in transact., Linn. Soc. xxv., 474-475 t. 17 (1866). Organ-Mountains.

This again might generically be held apart on account of the disconnected stamens with free very thin filaments and sagitate anther-connective, particularly so, should no transits to these characters be discovered in any yet unknown species.

5. *Thismia clandestina;* Sarcosiphon clandestinum; Blume Mus. bot. Lugd. Batav. i., 65 t. xviii. (1849) Java.

Imperfectly known, and therefore the generic place doubtful.

6. *Thismia Neptunis;* Beccari, Malesia i., 251 t. xi. (1878). Sarawak.
7. *Thismia Aseroe;* Beccari, Malesia i., 252 t. x. (1878). Singapore.

To this stands evidently in closest relation the simultaneously described and figured Thismia ophiuris from Borneo.

8. *Thismia clavigera.* Geomitra clavigera; Beccari, Malaisia I, 251, t. x (1878). Sarawak.
9. *Thismia episcopalis;* Geomitra episcopalis; Beccari, Malaisia i., 250 t. xi. (1878). Mt. Mattan, Borneo.
10. *Thismia Rodwayi;* Derwent, Tasmania.

This is nearest allied to the next foregoing.

The constitution of the word Thismia, as dedicatory to the Phyto-Anatomist Th. Smith, was unfortunate, though the name is euphonious.

Soon after this was written, several more specimens of the Thismia were found by Mr. Rodway and kindly transmitted to me; they came from the lower portion of the eastern slope of Mount Wellington. He noticed the plant to grow also on the roots of Bedfordia, and he further ascertained that the unpleasant odour of the flower is only developed in the process of decay. Root ramified into few filiform somewhat carnulent divisions. Stem one, or when two stems occur, distant, sometimes very short. The three shorter lobes of the calyx exterior, but at about the same level as the longer lobes, which can be regarded as petaline. Anthers concealed through the introflexion of the staminal tube, whereby they are pressed against the inside of the calyx-tube, so that intervening of insects becomes necessary for passing the pollen on to the stigmas. Outer part of the anther-connective ending upwards in two deltoid denticles, much overreached by an exceedingly tender setule. Pollen grains whitish when moist, almost dimidiate globular. Ripe fruit as yet unknown.

ON NEW SPECIES OF TASMANIAN ARANIEDÆ.

By A. T. Urquhart,
Corresponding Member of the Royal Society of Tasmania.

Fam. EPEIRIDÆ.

Gen. Epeira, Walck.

Epeira Mortoni, sp. nov. Plate. Fig. 1.

Femina.—Ceph. th., long, 4·8; broad, 4; facial index, 2. Abd., long, 10; broad, 6; legs, 1, 4, 2, 3 = 19, 14, 17·5, 10 mm.

Cephalothorax fulvus, greenish tinge, lake-brown reflections on cephalic part and lateral margins, fovea deeper shade; hairs white, silky, adpressed; slightly surpasses tibiæ of first leg in length; moderately depressed; pars cephalica depressedly convex, truncation visibly rounded, ocular eminence slight; lateral index equals two-thirds of facial; depth of *clypeus* scarcely equal to three-fourths diameter of an anterior centre eye; sides of pars thoracica well rounded; fovea large, sub-oval, longitudinal; caput and radial striæ slightly defined; profile-contour rises from thoracic junction at an angle of 30deg., slopes moderately across caput.

Fore and hind row of eyes tolerably and somewhat evenly recurved; fore-centrals of equal size; posterior, median-pair posited obliquely on dark, oval, prominent spots, separated by an interval equal to an eye's breadth and a half, scarcely their space and one-half from laterals; anterior centre eyes visibly more distant from each other than they are from hind pair, an interval rather exceeding their diameter; their space and a quarter from side eyes; laterals about one-third smaller than centrals, seated obliquely, more than half their radius apart, on separate tubercular eminences.

Legs fulvus, femora of two-first pairs reddish-brown, annuli reddish-fuscous; distal rings on femoral joints; central and apical on tibiæ and metatarsi; second half of tarsi shade off to dark brown; hairs dark, somewhat sparse; spines brown or black, numerous, irregular.

Palpi fulvus, fore-end of pars digitalis fuscous; hairs light; well spined; moderately long and slender.

Falces brownish-yellow, fangs dark; conical, vertical, flatly convex, length equals breadth of anterior row of eyes, their space visibly surpasses it.

Maxillæ fulvus, fuscous clouding; length perceptibly exceeds their breadth, much dilated at extremity, roundly pointed, inclined towards each other.

Labium darker than maxillæ; nearly as long as wide, conical.

Sturnum mahogany-brown, cordate, moderately developed eminences opposite coxæ.

Abdomen elongate-oviform, moderately convex above, sides steep, longitudinally wrinkled; base produced into two sub-conical elevations; deep lake-colour, with brownish penetrative tints, markings creamy-white; dorsal area displays two wide, sinuate, converging bands, extending from the rounded face of basal humps to second half of dorsum, enclosing a cunate area, where they are resolved into a series of more or less defined spots terminating at anus; side stripes broad, sinuate, compressed somewhat forwards, interrupted at the nearly free spots contiguous to base of humps; between the latter is a somewhat V-shaped mark, extremities dilated, central spot; this figure is followed by several more or less pronounced dots on median line of cunate area; the more strongly defined impressed spots occur on fore-half; anterior pair placed between humps, form a quadrilateral figure with second pair, longer than broad; latter pair included in the transverse line of four spots, which cause a constriction in each of the converging bands; central pair indent extremity of these bands, represent with second pair a trapezoid narrowest in front; lateral margins clouded with lake-black, display on superior line and interrupted border, resolved into spots; ventral shield, olive-green, passing into a brown on median line, margin, yellowish, elongate oval; *vulva* light greenish-yellow; wrinkled, sub-conical, prolonged into a remarkably long vermiform stylus, yellowish, two fore-thirds blackish, somewhat incrassated and depressed towards second half, sharply bent forwards, rapidly curved backwards; posterior face of corpus vulvæ displays a dark rimmed oval area, enclosed within is a fuscous plano-convex spot.

Var. a, *Cephalathorax* galbious, dorsum of caput and median band reddish brown, lateral margin fuscous. *Legs* galbious, femora of I. and II. suffused with brown-black, annuli broad, fuscous. Colouration of palpi lighter than legs. Pattern and colours of *abdomen* do not differ from type-form, except that the lake approximates more or less to a deep brownish-purple.

I have much pleasure in naming this handsome species after Mr. Alex. Morton, Curator of the Tasmanian Museum, to whom I am indebted for a large collection of spiders.

Epeira ventriosa, sp. nov.

Femina.—Ceph. th., long, 5·7; wide, 4·5. Abd., long, 12; wide, 11; legs, 1, 2—4, 3 = 22, 20, 13 mm.

Cephalothorax lake-brown, passing into brown on posterior incline and lateral borders, moderately clothed with adpressed, silky, whitish hairs; depressed; length equals metatarsus and tarsus of a leg of fourth pair; pars cephalica sub-aplanate, squarely truncated, ocular-eminence prominent; facial index exceeds lateral by one-fourth, equals one-half breadth of thorax; depth of *clypeus* plainly surpasses diameter of a fore-centre eye; pars thoracica ovate; indentation trisected; caput and radial striæ faint; contour of profile represents a moderate, even arch.

Fore-centre *eyes* of about equal size, form a quadrilateral figure widest in front; posterior row slightly recurved, median eyes rather further from fore-pair than they are from each other, an interval visibly surpassing their diameter; their space and a half from laterals; curvature of anterior row perceptibly stronger than hind row; median eyes separated by an eye's breadth and a half, divided from side-eyes by their space and a quarter; laterals one-third smaller than centrals, posited obliquely on a forward projecting tubercular elevation, less than their radius from each other.

Legs and cephalothorax concolorous, annulations broad, brown, not clearly defined; hairs fine, somewhat sparse; spines yellowish, base dark; fairly numerous, irregular; tibial spines equal to its own diameter in length; legs moderately stout, tibial joints cylindrical.

Palpi fuscous, annuli deeper tone; length equal to metatarsus and tarsus of first leg; spines numerous on radial and digital joints; palpal claw short, well curved, 9 teeth, 3 basal rapidly decreasing in size.

Falces deep, raw-sienna; conical, vertical, strongly gibbous at base in front; fore-third divergent, as stout as the femur of a third leg, length equal to anterior row of eyes; 4 teeth on outer row; inner 3.

Maxillæ nearly as broad as long, extremity much dilated, roundly pointed, inclined over *labium*, which is wider than long, sub-triangular; organs olive-brown, pale margins.

Sturnum mahogany-brown; hairs light; cordate; eminences opposite coxal joints.

Abdomen broad-oviform, base pointed; profile-contour ovate; humeral tubercles obtuse-conical; rather sparsely clothed with short, black bristle-like hairs, and soft white, latter following the lighter tints; pattern somewhat obscure; ground colour creamy-brown, mottled, ill-defined patches of a pale olive-brown, few orange-red stains, most pronounced about region of centre figure and tubercles; basal half displays an olive-brown cruciate figure, composed of two longitudinally placed, spindle-shaped spots, and two much smaller lateral spots in line with tubercles; lateral margins show a series of chocolate-brown rib-like streaks, convexities directed backwards; basal end displays a series of fine horizontal streaks, limited by first rib-like line; ventral surface chocolate-brown; shield pale burnt-sienna, large, brown, trapezoidal mark in centre; spinners short; *corpus vulvæ* lake-brown; sub-reniform, of moderate size; sides abrubt, project outwards; face bordered by two narrow costæ, inner black, encloses a heart-shaped area containing two foveæ, divided by a longitudinal groove; apex of area limited by the rima genitalis; springing from anterior border of corpus is a long, tapering, flat, transversely rugose, hairy, yellowish scapus, curving backwards and upwards.

Single specimen. A.M.

Epeira notacephala, sp. nov.

Femina.—Ceph. th., long, 4; broad, 3; facial index, 1·5. Abd., long, 5; broad, 4. Legs, 1, 2, 4, 3 = 12·5, 11·5, 11, 7 mm.

Cephalothorax light brownish-orange, reddish dots, two fuscous spots transversely posited in centre of caput; thoracic part displays two rows 6—2 of similar tinted spots; hind and fore-centre pair enclose a V-shaped figure within fovea. This figure is connected by short bars with next pair of spots in anterior row; marginal band brown, projects a triangular mark on basal half, fades away forwards; fairly-well clothed with rather coarse, whitish, adpressed hairs; length equal to metatarsus and tarsus of a leg of first pair; pars cephalica sub-aplanate, sides abrupt, somewhat retreating; lateral index equals space between a fore-lateral eye and the central furthest from it; depth of *clypeus* equals diameter of a fore-centre eye; pars thoracica oval, convex, fovea sub-circular, shallow; normal grooves faint; profile-contour represents a somewhat prominent arch, cephalic and thoracic incline of about equal grade.

Eyes of fair size, placed on fuscous rings; posterior row perceptibly recurved; median pair visibly more than an eye's breadth apart, their space and one-third from laterals of same row; anterior row more distinctly recurved; centrals one-third larger than hind pair, perceptibly closer to these eyes than they are to each other, an interval surpassing their diameter by one-fourth; divided from side eyes by rather less than two-thirds their space; laterals scarcely one-third smaller than posterior centrals on fuscous rings, oblique, about two-thirds their radius from each other; fore-eye posited on a yellowish projecting tubercle.

Legs pale yellowish stone-colour, fuscous patches and spots on inferior side of femoral and coxal joints, indications of annuli on metatarsi; tarsi shade off rapidly into reddish-fuscous; hairs pale-yellow; spines yellowish, dark base; fine; tibial shorter than transverse diameter of article, numerous; tibiæ of I. and II. have on inferior side a double row of 5, 5; metatarsi 4, 3; legs moderately strong; II. and IV. of about equal length; patellæ and tibiæ compressed, grooves slight; superior tarsal claws—1st pair, 9 comb teeth; inferior claw 2 points.

Palpi colour and armature of legs; length, 4·6 mm.; palpal claw well curved, 10 comb teeth, 2 basal small.

Falces fulvus, glossy, apices brownish; conical, base in front gibbous, vertical, slightly exceed pars digitalis of palpus in length, as stout as the femur of a first leg; double row of black teeth, outer 4, inner 3.

Maxillæ greenish-yellow, centre clouded with light-brown, rather longer than broad, enlarged forwards, obtusely pointed, inclined towards each other.

Labium pale greenish-yellow, base fuscous, wider than long, triangular.

Sturnum light-brown, passing into dark chestnut-brown on margins, spotted; cordate, eminences opposite coxal joints.

Abdomen sub-triangular, base truncated, depressed, humeral tubercles well developed, conical apices brownish, semi-pellucid, project upwards and somewhat backwards; posterior tubercle stout, conical, prominent wrinkle or tubercle beneath; lateral borders rugose; hairs somewhat sparse, appressed, whitish, few pale yellow, dark based, short bristles project from fuscous spots; integument pale brownish stone-colour; folium tapers from fore-tubercles to posterior tubercle, defined by a light fuscous, sinuating line; median streak similar shade; three pair of blue-black impressed spots, two anterior pairs largest, form a trapezoid narrowest in front; light fuscous, nearly vertical, bands on lateral margins. *Corpus vulvæ* fulvus, somewhat triangular, convex elevation, wrinkles transverse, well-defined; broad and concave in front, margins tumid; projecting from within the dark concavity is a yellowish, rather wide septum, as broad at truncated apex as long.

Several examples. A. M.

Epeira singulara, sp. nov. Plate. Fig. 2.

Femina.—Ceph. th., long, 4; broad, 3·4; facial index, 2. Abd., long, 6·7; broad, 6. Legs, 1, 2, 4, 3 = 13, 12, 11, 8 mm.

Cephalothorax bright brownish-lake, clouded about caput and lateral margins with blackish-lake; hairs somewhat sparse, silky white and dark, former predominate on thoracic part; pars cephalica flatly-convex, dips abruptly into depression on posterior incline of thorax; truncation perceptibly rounded, ocular elevation fairly developed, lateral index equals space from a hind-lateral eye to central of same row furthest from it; depth of *clypeus* scarcely equal to diameter of a fore-centre eye; pars thoracica broad-oval, convex, hind-slope occupied by an orange-brown, semi-oval, flatly-convex depression, fovea at apex, triangular, slight; normal grooves not well-defined; profile-contour rises from thoracic junction at a moderate angle, caput curve slopes at an angle of 35deg. to hind-row of eyes.

Posterior and anterior row of *eyes* moderately recurved; hind-median pair separated from each other by an interval equal to their diameter and one-half, and from laterals by their space and three-fourths; fore-centre eyes plainly more than their breadth from one another, rather less than an eye's diameter from posterior centrals, which they equal in size; distance separating them from side eyes visibly surpasses their space; laterals about one-half size of centrals, posited obliquely on moderate tubercular elevations, nearly contiguous.

Legs, femora, especially of I. and II., bright brownish-lake, other joints fulvus, green tinge; annuli fuscous, indications on thighs of III. and IV.; two wide annulations on patellery joints; three on tibial and metatarsal; fore-end of tarsi fuscous; moderately haired; spines brownish, somewhat sparse; tibial spines scarcely equal, transverse diameter of article; patellæ and tibiæ compressed, show two longitudinal grooves; former articles two-thirds length of latter, of equal length on third pair; superior tarsal claws—1st pair, stout, well curved, 8 teeth, 5 strong combs, 3 basal close small; inferior claw long, sharply bent, 2 small points.

Palpi fulvus, green tinge, annuli of pars humeralis and two fore-thirds of digital joint chestnut-brown; hairs whitish; spine armature moderate; palpal claw less curved than tarsal; nine teeth increasing in length and strength.

Falces reddish-chestnut, strongly gibbous at base in front, conical, vertical, half as broad as long; length equal to space occupied by front row of eyes; outer row of teeth, 4; inner, 3.

Maxillæ, length and breadth at extremity about equal, roundly pointed, inclined over *labium*, which is perceptibly wider than long, roundly and somewhat sharply pointed; organs, dark fuscous, margins, greenish-yellow.

Sturnum, lake-black; hairs, white; cordate, centre prominent, eminences opposite coxæ moderate.

Abdomen angular-oviform, projects over base of cephalothorax, depressedly convex above; contour of profile represents a somewhat even curve across dorsum, dips abruptly to spinners from first row of tubercles, depth of dip equal to about one-half length of abdomen; humeral tubercles obtuse-conical, project upwards and outwards; posterior tubercles, 5; first row slightly developed; tubercle of second row most prominent; clothed with short copper-coloured and white hairs; integument has a soft velvety appearance, brownish-fawn colour, speckled with light-brown, largest and scarcest spots deepest hue; folium tapers from humeral tubercles to spinners; margins sinuate, fuscous; flesh colour of tubercles encroaches into the normal fawn-colour; in line with eminences is a centrally-broken fuscous, oblong, transverse mark, connected by a short band with a greenish, ill-defined bar, surpassing the former in length; these marks occur between first and second pair of impressed spots; base of folium angular, defined by dark shading; at constriction of folium on posterior side of second pair of spots is a broken cross-bar; second occurs below third pair of impressed spots; posterior two-thirds of compressed portion of folium obliterated by a remarkable, large, sinuated, brass-coloured patch, metallic reflections, which curves round, suffusing almost all the right side of abdomen; ventral surface dull brown, lake tinge, fuscous clouding; shield fuscous. *Corpus vulvæ*, deep orange, costæ passing into red chestnut, scapus similar tints; stylus lemon-yellow; corpus trapezoidal nearly as wide at base as long, longitudinally depressed, laterally bounded by deep, projecting costæ, increasing somewhat in width towards, and revolute above the rima genitalis; scapus vulva curves over base of corpus, three-fourths its length, elongate-oval, transversely wrinkled, lateral border wide, tapers at fore-end, incurvate; apex of scapus projects rather beyond base of stylus; latter strongly segmented, base stout, second half tapers rapidly, about three-fourths length of scapus.

Only a single example of this handsome species was contained in Mr. Morton's collection; probably the remarkable irregular metallic markings on the abdomen are unique.

Var. a.—Colouration of *cepthalothorax* and *legs* resemble type-form. *Abdomen* grayish-fawn colour, markings deeper tone; pattern does not differ essentially from type-form.

Two specimens. A.M.

Epeira viridula, sp. nov.

Femina.—Ceph. th., long., 2·5; broad, 1·8; facial index, 1. Abd., long., 4; broad 3·5. Legs, 1, 2, 4, 3. = 7·5, 6·5, 6, 4 mm.

Cephalothorax light brown, fuscous clouding; fairly clothed with whitish hairs; clathrate; pars cephalica moderately convex, roundly truncated, ocular elevation prominent; *clypeus* in height visibly less than diameter of a fore centre eye; pars thoracica broad-ovate, convex; posterior incline depressed; fovea sub-oval, shallow, radial striæ well defined, caput grooves moderately; profile line rises from thoracic junction at a tolerable angle to limit of caput, latter horizontal, perceptibly arched, eye eminence projects forwards.

Anterior and posterior row of eyes moderately and somewhat equally recurved; hind median eyes largest of eight, posited obliquely on the more prominent part of eminence, divided from each other by an interval equaling an eye's diameter and two-thirds, and from laterals of same row by scarcely their space and a quarter; fore-centrals less than one-third smaller than hind-pair, visibly more than their diameter from them, removed from each other by a space equal to an eye's breadth and one-quarter, separated from side eyes by rather more than their space; laterals about half size of fore centrals, seated obliquely on a common, strongish tubercle, their radius apart.

Legs fulvus, faint green tinge, fuscous patches on femoral joints, resolved somewhat into distal rings, on III. and IV.; patellæ clouded, tibiæ and metatarsi two annuli; hairs white, somewhat sparse; spines light, scarce; legs strong, patellary and tibial joints compressed, two well-defined grooves; superior tarsal claws—1st pair, 9 comb teeth; inferior claw 2 points.

Palpi colour and armature of legs; palpal claw 10 teeth.

Falces light-fulvus, clouded, conical, vertical, basal half prominent in front; length rather shorter than radial and digital joints of palpus, about as stout as the femur of first leg.

Maxillæ, length somewhat surpasses breadth, enlarged forwards, roundly pointed, inclined over *labium*, latter nearly as long as wide, well pointed, margin tumid; organs chocolate brown, fore-end pale olive brown.

Sturnum blue-black; cordate, eminences opposite coxal joints well-developed.

Abdomen oviform, depressed, humeral tubercles obtuse-conical, directed somewhat outwards and backwards; posterior tubercles well-developed, centre tubercle of first row much the largest and stoutest; tubercle of second line as strong as central of first; third short and fattened; pale brownish-fawn colour, suffused in more or less transverse patches, with dull rifle-green, few spots of same hue; margin of folium acutely sinuate, commences at base of humeral prominences, curves over, tapers to posterior row, obliterated on dip of abdomen; inner border olive-brown, outer creamy-brown; short angular mark of same colour on basal end; ill-defined, somewhat lanceolate, greenish figure in centre of dorsum; lighter shade predominates on ventral surface; shield olive-green, oval. *Vulva* pale yellowish-brown; represents a low, transverse, oval elevation, prolonged into a broad, tapering, flatly convex, close lying scapus, fore-end slightly segmented.

Single example. A. M.

ÆREA, gen. nov.

Cephalothorax rather longer than broad, sub-parallel, lateral constriction slight; cephalic part large, elevated, rather abruptly inclined on all sides from posterior central eyes; anterior angles prolonged into strong, abscinded, sub-conical prominences, depressed above, directed outwards and forwards beyond the frontal line; *clypeus* retreating, centrally prolonged, pointed, depth equal to the space occupied by the fore-centre eyes; thoracic part depressedly convex; at junction with caput on same plane as anterior median eyes, indentation, radial and caput striæ shallow and irregular; contour of profile represents a rather even line rising from thoracic junction, at an angle of 30deg., to posterior central eyes, incline across ocular area somewhat more abrupt.

Eyes tolerably small, in three rows—4, 2, 2; or two procurved rows, posterior line being very strongly curved; fore-centrals form a trapezoid narrowest in front, rather longer than broad behind; laterals posited on truncated apex of lateral projections.

Legs of moderate and somewhat equal length, 1—2, 4, 3; first and second pairs stoutest, of about equal strength; patellary, tibial and metatarsal joints of two first pairs sub-aplanate; patella rather shorter than tibia, metatarsus and tarsus of about the same length; together nearly equal the two former articles in length; tibial and metatarsal joints armed their entire length, on both edges, with long, curved spines, intermediate spaces occupied by 3 or 4 smaller spines of similar form; tarsi furnished with an inner and outer row of close spines, not differing from metatarsal, except that they are shorter and of somewhat even size; tibiæ and metatarsi of third and fourth pairs have a few straight spines; superior tarsal claws of first pair, short, well-curved, 8 comb-teeth; inferior claw sharply bent; axillary claws.

Palpi moderately strong, armed with spines; palpal claw long, slender, 7 teeth, free end short.

Falces of tolerable strength and length, inwardly inclined.

Maxillæ short, length perceptibly surpasses the breadth, fore-end enlarged, roundly pointed, directed towards the *labium*, which is semi-circular, everted, breadth exceeding the length. *Sturnum* sub-oval.

Abdomen sub-rhomboid, base truncated, posterior extremity enlarged, somewhat depressed above

Ærea alticephala, sp. nov. Plate Fig. 3.

Femina.—Ceph. th., long, 3; broad, 2·5; facial index, 2·4. Abd., long, 5·5; broad, 5·5. Legs, 1—2, 4, 3 = 7·5, 6·5, 4. mm.

Cephalothorax lake-black about ocular area, fore-sides of thorax, and lateral margins; dark shade passes between hind-median eyes tapering to limit of caput, enlarged at fovea; posterior incline of cephalic and thoracic parts fulvus, passing into a brownish lake; hairs whitish, appressed, somewhat in lines; luconose; sub-parallel, rounded posteriorly, lateral constriction slight; pars cephalica elevated, slopes on all sides rather abruptly from hind central eyes; grooved depression between latter; fore-angles developed into very stout, sub-conical projections, flatly convex above, directed outwards and forwards beyond frontal line; *clypeus* retreating, pointed, height equal to space of anterior median eyes; pars thoracica depressedly convex, on same plane as fore-centre eyes at its junction with caput; fovea shallow, ill-defined; caput and radial striæ slight, irregular; profile-contour rises from thoracic junction with a somewhat even line to posterior median eyes, at an angle of 30deg, slopes rather more abruptly to anterior centre eyes.

Eyes rather small; anterior row procurved; line through centrals intersects lateral pairs; median eyes posited somewhat obliquely on small, crimson-lake, discoid tubercles, separated from each other by an interval perceptibly exceeding an eye's breadth, and from laterals of same row by nearly twice their space; posterior row straight; forms a very strongly procurved line, with eyes of second row; eyes one-fourth larger than anterior pair, seated obliquely on well-developed, crimson-lake, discoid elevations, about one-fourth further from fore-centrals than they are from each other, an interval surpassing space of anterior pair by scarcely one-third; interval between tubercles fully equal to one-half the distance dividing them from fore-pair of tubercular eminences, separated from hind-laterals by their space and a half; side-eyes placed obliquely on abscinded apices of lateral projections, anterior eye more than twice size of posterior, latter about equal to a fore-central, divided from eye next to it by rather more than one-fourth its own diameter.

First and second pairs of *legs* lake-brown, suffused with chocolate-black, somewhat obscure annuli on tibiæ; hind pairs fulvus; coxal joints, two distal thirds—more or less—of femora and patellæ suffused with dark chocolate-brown; wide basal annulations on tibial, metatarsal and tarsal joints of same shade; legs, 1st pair rather stout, thighs compressed; patella and tibia sub-aplanate, former article grooved, less than one-fourth shorter than tibial joint, latter sub-linear; metatarsus and tarsus of nearly equal length, together scarcely surpassed by the patellary and tibial joints; penultimate article aplanate, base incrassated; hairs whitish and yellowish, most numerous on tibiæ of I. and II.; tibial and metatarsal joints of I. and II. armed their entire length on both edges with long, flattish, brown, curved spines, directed forwards and outwards; metatarsal longest; tibiæ have about 6 on each side; metatarsi 7 on inner, 4 on outer edge; space between long spines occupied by from 3 to 4 much shorter spines of similar form and colour; lateral sides of tarsi armed the whole length with close spines similar but shorter than metatarsal; tibiæ of III. have about 3 spines beneath, 1 above; metatarsi 3 or 4 on inferior side; tibiæ of IV.; IV. pair 1 on superior, 3 or 4 on inferior side; metatarsi 4 or 5; superior tarsal claws—1st pair, short, well curved, 8 comb teeth; inferior claw sharply bent, points? axillary claws.

Palpi, humeral and cubital joints fulvus, former article clouded, radial and digital lake-brown, clouded with black brown, both articles fairly furnished with hairs; cubital joint 1 spine; radial 2; digital 7; humeral rather shorter than two following articles together, two latter scarcely equal digital joint in length; palpal claw long, slender, first half straight, second moderately curved; 7 teeth, free end short.

Falces glossy, deep chocolate brown, apices lake tinge; bristle-like hairs at extremity, conical, inclined inwards, scarcely as long as radial and digital joints of palpus, rather stouter than the pars femoralis of a first leg; double row of 5 short teeth.

Maxillæ light reddish brown, pale greenish yellow apices; short, breadth nearly equals length, dilated forwards, roundly pointed, directed towards each other.

Labium chocolate brown, apex pale greenish hue; semicircular, perceptibly wider than long, everted.

Sturnum, dark fuscous; few coarse hairs, sub-oval.

Abdomen sub-rhomboid, base truncated, posterior fourth tumid, convoluted, dotted with small pits, sides dilated; dorsum rises, almost in line with humeral angles, into an obtuse-conical elevation; lateral margins longitudinally wrinkled; abdomen prolonged nearly one-third its length beyond spinners, which are short; darker parts, more especially, marked with rather large, circular or oval lacunose depressions, surrounded by numerous, very fine, sinuating wrinkles; hairs white, short, sparse; ground colour marbled with purple-black and brown; large, deep, creamy-coloured, cruciate figure occupies dorsal area, fore-part nearly as wide as long, displays five light brown impressed spots, three form a procurved line near basal margin, two occur at foot of conical elevation, latter pair and centre spot of anterior line connected by a slight bluish cross; base of cruciate figure short, compressed, terminates at the creamy-coloured posterior third, this part throws off into the dark integument marks of irregular shape, connected with the somewhat sinuating, transverse bar, which curves round humeral angles passing into the creamy coloured ventral surface; vulva and spinners enclosed within an olive-black patch; triangle of three spots in centre, apex directed backwards. *Corpus vulvæ,* dull lake-brown; sub-reniform, moderately depressed area, bounded by an involute costa, inferior margin low and somewhat rugose, much enlarged at curvature, curved extremities divided by a pointed septum, whose breadth scarcely equals the greater width of costa; above the rima-genitalis are two short, black, clavate processes, directed towards apex of septum.

Single specimen. A.M.

COLLINA, gen nov.

Cephalothorax rather longer than broad, sharply constricted on lateral margins; cephalic part roundly truncated, ocular elevation low; fore-half depressedly convex, sides somewhat abrupt, depth exceeds breadth of dorsal surface; fovea and normal grooves well-defined; contour of profile strongly arched, highest part at the occiput; fore-third of caput inclined at an angle of about 45deg.

Eyes of moderate size, sub-equal, posterior and anterior rows slightly recurved, fore-centre eyes form a trapezoid widest in front; laterals separated from each other by an interval scarcely equal to their own radius.

Legs rather slender, moderately long—1, 2, 4, 3; first and second, third and fourth of about equal strength; patellary and tibial joints cylindrical; armature sparse, hairs fine, outstanding; spines slender, bristle-like; superior tarsal claws moderately curved; axillary claws.

Palpi, cubital, radial and digital joints, furnished with long, slender spines; numerous on the penultimate and terminal joints.

Falces conical, inclined forwards, stout.

Maxillæ enlarged towards extremity, roundly pointed, inclined towards *labium* which is rather wider than long, roundly pointed.

Sturnum cordate, eminences opposite coxæ well-developed.

Abdomen oviform, large.

Collina glabicira sp. nov. Plate fig. 4.

Femina.—Ceph. th., long, 4; broad, 3. Abd., long, 7; broad, 5·8. Legs, 1, 2, 4, 3 = 15·5; 12·5; 11·5, 9 mm.

Cephalothorax, chrome-yellow, suffused with a light-brown on cephalic part; freckled with brown; lateral border deeper tone; hairs pale, very sparse; length equals patella and tibia of 4th leg; pars cephalica large, first half depressedly convex, sides somewhat abrupt, roundly truncated, eye eminence low; lateral index equals two-thirds of facial; *Clypeus* retreating, surpasses in depth diamater of a fore-median eye; pars thoracica oval, convex, fovea sub-oval, caput and radial striæ tolerably strong; profile-contour strongly arched, prominent at occiput, dips across fore-third at an angle of 45deg.

Eyes of tolerable and about equal size, on blackish-lake rings; posterior row slightly recurved; centre-eyes divided by three-fourths their diameter, rather more than their space from laterals; anterior row more distinctly recurved, median pair less than their diameter and a half from each other, perceptibly more than an eye's breadth from hind-centrals, removed scarcely three-fourths their space from side eyes; laterals placed obliquely on separate lake-brown tubercular eminences, somewhat less than their radius apart, tubercles small, anterior strongest.

Legs somewhat duller hue than cephalothorax, tibial and metatarsal joints greenish shade; hairs fine, black; spines slender, black; 2 or 3 on femora; patellæ 1; about 6 on tibiæ of I. and II., less on same article of two hind-pairs; metatarsal joints apparently devoid of spines, except metatarsi of III., which have 1 spine; legs somewhat slight, patellery and tibial joints cylindrical.

Palpi and legs concolorous; bristle-like spines rather numerous on pars radialis and digitalis; humeral joint equal in length to cubital and radial together; two latter articles as long as digital joint.

Falces chrome-yellow; hairs black, sparse; conical, base gibbous, inclined forwards; small, plano-convex, conical lobes on outer side.

Maxillæ pale fulvus, base lightly suffused with olive brown, nearly as wide as long, dilated forwards, roundly pointed, directed towards each other.

Labium yellowish, fuscous shading; rather wider than long, roundly pointed, one-half length of maxillæ.

Sturnum fulvus, marbled with brown; heart-shaped, eminences opposite coxal joints.

Abdomen broad oviform, projects over base of cephalothorax, convex above; ground colour dull lake-brown, suffused with flecks; dorsum flecks dark creamy-colour, lobate, more or less confluent; medial streak, normal colour, terminates at posterior incline, displays four—probably in some examples five—arcuate lines of similar colour; flecks on lateral margins inconspicuous, approximate to ground colour; ventral shield olive brown; branchial opercula chrome-yellow. *Vulva* orange brown; transverse, oval area, occupied by two deep, circular foveæ, intersected by a dark bordered, broad septum, their equal in breadth, laterally prolonged above the rima genitalis, extremities acute, revolute.

Single example. A.M.

FAM. CELAENIDEN.

Gen. CELAENIA, Thor.

Celaenia voraginosa, sp. nov. Plate Fig. 5.

Femina.—Ceph. th., long, 5·2, broad, 6. Abd., long., 10; broad, 14; deep, 11. Legs, 1—2, 4, 3 = 21·2, 12, 10 mm.

Cephalothorax deep fulvus, olive tinge, passing into coffee-brown on lateral margins, furnished with numerous papillæ—mostly in rows, projecting, short, stout, black bristles; somewhat reniform, narrowly constricted at caput, pars cephalica, rather depressed, sides abrupt, mamiform eminences well-developed; prolonged somewhat upwards into a stout sub-conical projection, nearly as long as wide at base, occupying greater part of frontal space; *clypeus* retreating, depth perceptibly exceeds interval between a fore-centre eye and the lateral next to it; pars thoracica—viewed laterally, obtuse-conoid; series of six indentations occur at edge of posterior inclination, centre pair divided by the bisected fovea; radial striæ somewhat deep and short; caput grooves faint forwards, form strong, angular depressions at limit; profile-line rises at an angle of 30deg. from thoracic junction, dips forwards at a rather stronger inclination to mamiform elevation—which represents an obtuse-conoid projection, bends slightly upwards to posterior row of eyes.

Eyes tolerably small; posterior row recurved, line through centrals strikes fore-edge of anterior laterals, front row more strongly recurved; fore-central eyes posited on prominence, form a nearly quadrilateral figure, enclosing conical apex, front line rather shorter than hind, visibly surpasses sides; posterior pair one-third smaller than fore-centrals, placed on slight discoid elevations; anterior pair little more distant from side eyes than are the hind-centrals, a space about equal to the interval between one another; laterals scarcely equal to hind centrals in size, seated obliquely on a strong prominence nearly contiguous.

Legs creamy-yellow, second half—rather less—of femoral joints coffee-brown, stains on first half; patellæ and annulations normal brown; tibiæ have three wide rings; metatarsi three less defined annuli; tarsi suffused; annulations on tibial and metatarsal joints of two posterior pairs somewhat obliterated; I. and II., III. and IV. of about equal strength;

femora of two first pairs much the stoutest; tibial joints cylindrical, slender, about one-third longer than patellæ; metatarsi nearly twice length of tarsi, together one-third shorter than tibæ; hair short, somewhat sparse; femoral joints of I., II. and III. armed on inferior side with two irregular rows of sub-conical tubercles of various sizes, projecting short spines, tarsal claws of normal form; outer claw much the longest and strongest; inner sharply curved, three close teeth at base; inferior claw closely inflected, perceptibly stronger than inner; two pairs of axillary claws.

Palpi, pars humeralis creamy-yellow, brown rings, following joints fulvus, suffused with brown; armature short, black hairs; moderately long, stout; radial joint rather the longest and strongest, enlarged forwards; cubital joint much the shortest; pars humeralis and digitalis of about even length; palpal claw stout, sharply bent, 3 close teeth.

Maxillæ light coffee-brown; apices pale, greenish; moderately enlarged forwards, pointed, directed towards each other.

Labium base brown, fore-half pale; oval, rather wider than long.

Sturnum chocolate-brown, well-defined, large, yellowish lanceolate figure in centre, point directed towards lip, haft tapers to posterior end; cordate, tapers from the somewhat prominent eminences opposite coxal joints of third pair.

Abdomen large, nearly one-third wider between humeral tubercles than long; base rather broader than cephalothorax, concave, angles prominent, rounded; viewed laterally conoid, apex abscinded; summit occupied by large convoluted, somewhat semi-globose humps, sloping abruptly to the short, conical humeral tubercles, divided by a level space about one-half their own diameter; each hump indented by seven deep pits, three of which occur on each margin of intervening space; hind lobes of humps project over the abrupt posterior end, which is semi-oval; the outer pair display at their extremity brownish, nipple-like tubercles; posterior face of abdomen shows several well-marked foveæ, two largest form a trapezoid, widest below, with the hind-pair of the above-mentioned six pits; semi-circle of five impressed spots on posterior side of humeral tubercles; between hind-pair of foveæ and spinners is a large, somewhat oval space enclosed by small pits, area occupied by two centrally interrupted, transverse indentations; anterior slope slightly pitted; fore-part of abdomen creamy-colour, graduating into patches of pale brownish tints; on margin of basal concavity is a black, heart-shaped figure, on either side of it two streaks curve off towards fore-tubercles, upper streak brown, lower bluish; summit and posterior side light greyish fawn colour; humps and fore-sides appear to be tattooed with bluish lines, pattern on fore-slope without any determinate limits, fades away into ground colour; anterior border of humps and posterior border of fore-patches blackish, somewhat sinuating, curve round the creamy-brown humeral tubercles; resolved behind into conspicuous, indigo-coloured, lunulate marks curving upwards round apex of the semi-oval area; latter and impressed spots on posterior region reddish. *Vulva* represents a narrow, transverse, brownish depression, projecting—over the rima genitalis, a moderately deep, cup-shaped, yellowish process.

Single example. A.M.

Celaenia tumidosa, sp. nov.

Femina.—Ceph. th., long, 6; wide, 6·8. Abd. long, 10·2; wide, 15; deep, 10. Legs, 1—2, 4, 3 = 23, 14, 12, mm.

Cephalothorax light mahogany-brown, passing into pale yellow-brown on margins, olive tinge; somewhat suffused and speckled with olive-brown; numerous papillæ projecting short, black hairs, chiefly in rows; cephalic part somewhat aplanate, sides abrupt; produced forwards and moderately upwards into a strong sub-conical projection; mamiform eminences well-developed; *clypeus* retreating, height visibly surpasses interval between a fore-median eye and the lateral next to it; thoracic region—viewed laterally, conoid, margin of hind-slope displays six rather deep indentations, bisected fovea intersects central pair; radial striæ well-defined, short; caput grooves represent deep angular indentations at junction with thorax, shallow forwards; contour of profile rises from thoracic junction at an angle of 30deg., inclined at about the same angle to base of the obtuse-conical mamiform prominences, bends slightly upwards to hind row of eyes.

Eyes rather small; fore-centrals about one-third larger and fore-laterals one-third smaller than hind-median pair; posterior lateral eyes visibly smaller than anterior pair; posterior row recurved, line through centrals intersects side-eyes; anterior row recurved, curvature stronger than posterior; fore-centrals seated on prominence, enclose conical apex; hind-pair rather more distant from each other than are the fore-pair, interval between latter pair visibly surpasses the space separating them from posterior centrals, which are posited on small discoid tubercles; fore and hind-centre eyes divided from laterals by an interval perceptibly exceeding space between fore-centrals; side eyes seated obliquely on tolerably strong elevations; three-fourths diameter of a posterior eye apart.

Legs green-tinged straw-colour, markings coffee-brown; second half of femoral joints dark; first half of anterior pair splashed; patellæ uniform brown, more or less broken and confluent annuli on tibiæ; fore-end of metatarsi and tarsi suffused; I. and II., III. and IV. of about equal strength; thighs of first and second pairs much the strongest; tibiæ cylindrical, slender, one-third longer than patellary joints; metatarsi twice as long as tarsi, together shorter than tibial joints by one-third; hairs, fine, short; femoral joints of first, second, and third pairs armed beneath with two irregular rows of sub-conical tubercles, of different sizes; projecting short black spines; outer superior tarsal claw much the stoutest and longest; inner claw sharply curved; three close teeth; inferior claw closely inflected, somewhat exceeds inner both in length and strength; axillary claws.

Palpi greenish-brown; armature, fine, black hairs; stout, moderately long; radial joint incrassated forwards, surpasses other articles in length and strength; pars cubitalis, short; penultimate and digital joints of about same length; palpal claw short, sharply bent; three close teeth.

Falces greenish-brown, suffused with a deeper shade; somewhat hairy; taper moderately, directed inwards, fully as long as pars radialis of palpus; about as stout as basal end; fang, short.

Maxillæ, light greenish-brown, short; second half dilated, roundly pointed, directed towards each other.

Labium and maxillæ concolorous, perceptibly broader than long, semi-circular.

Sturnum fulvus, border fuscous, haired, oval.

Breadth of *abdomen* between the short, outward projecting humeral tubercles exceeds the length by scarcely one third; profile contour sub-conoid, anterior slope moderate, posterior dip abrupt; base procurved between anterior rounded protuberances; crest occupied by two large semi-globose, convoluted humps, prominent behind, separated by a level area about one half their diameter; impressed spots which occur on humps and on the fore and hind smooth regions do not differ essentially in their arrangement from the similar indentations found on *T. voraginosa*; ground colour of anterior slope creamy-fulvus, black heart-shaped spot above petiole throws off on either side, two olive-black sinuating lines converging towards each other on inner side of fore protuberances, latter display at their base, upper side, a dark impressed spot; humps closely tattooed with bluish-green lines and leaf-like marks; sides of anterior incline figured with similar but more open pattern; posterior side has a light copper-brown hue, suffused with an olive-brown shade, faint bluish streaks, indentations similar tint. *Vulva* (somewhat shrunken) represents a transverse, brownish, oval indentation, margin above the rima genitalis produced into a rather large everted lip, brownish yellow above, whitish beneath.

Single example. A. M.

EXPLANATION OF PLATE.

Fig. 1. *Epeira Mortoni*, sp. nov. Vulva.

Fig, 2. *Epeira singulara*, sp. nov. Vulva.

Fig. 3. *Ærea alticephala*, sp. nov. Female, three times natural size ; a, caput ; b, part of a fore-leg ; c, vulva.

Fig. 4. *Collina globicira*, sp. nov. Female, three times natural size ; a, vulva.

Fig 5. *Celaenia Voraginosa*, sp. nov. Caput.

NOTES ON ACTINOMYCOSIS, AND ITS TRANSMISSIBILITY TO THE HUMAN SUBJECT.

By C. E. Barnard, M.D.

While I cannot but feel that some apology is due to the Royal Society for introducing a subject that might perhaps be regarded as purely medical, this feeling is removed by the consideration of its important bearing upon the public health, and may be held to justify me in bringing it before the Society. I refer to the question of the transmissibility of some bovine diseases to human beings by the consumption of the meat of diseased animals.

The primary object of my paper is to show that there is prevalent amongst the cattle in Tasmania, as well as in the adjacent colonies, from which we obtain a large proportion of our meat supply, a disease which resembles tuberculosis in some respects, but differs from it in the specific micro-organism that is the cause of the disease, and yet, like tuberculosis, is transmissible to the human subject, and is almost as distressing in its consequences.

Six years ago Dr. Perkins read an interesting paper before this Society on "Cancer in Cattle," and ably pointed out the probable danger of the use as food of animals affected with cancerous or osteo-sarcomatous swellings; and he urged that precautions should be taken to avoid the probable transmission of cancer to man by eating the flesh of animals so diseased.

As the tumours in the cases described resembled in external appearance those swellings that are undoubtedly due to a scrofulous taint or tuberculosis, Dr. Perkins considered that they also might be classed as such; and judging by his paper, he apparently was unaware of the true nature of the disease in question. He well described the appearance of the swellings, and, by microscopical and other specimens, he showed how the bone was affected, and how the tumours grew and formed secondary deposits in the system; but there is no mention of the specific micro-organism which is now found to be the cause of the growth.

At the time of his writing the paper there was no accurate knowledge available that would give any clue to the true cause of the cancer. Dr. Perkins himself did not regard it as ordinary cancer, for he says that "though I have examined several specimens, I have not yet come upon cells which in any way resemble those of cancer," and he favours the idea that the tumours are due to tuberculosis.

Previous to Dr. Perkins's paper, Mr. Willows, N.S.W. Government Veterinarian, in conjunction with Mr. Park of Hobart, was empowered by the Hon. the then Premier of Tasmania to report upon the alleged cancer in cattle of this colony. In his report Mr. Willows considered the tumours to be due to a tuberculous taint; and he urged that prophylactic measures be rigidly enforced with a view to stamp out the disease, and he concludes by saying, "I am of opinion that the consumption of meat or milk from scrofulous or tuberculous animals is always dangerous."

In Europe this disease, so far as it was judged by external appearances, had been long recognised, and was described under various designations, such as osteo-sarcoma, cancer, etc., and usually it was attributed to a tuberculous condition of the system affecting the glands.

It is only of comparatively recent years, since 1876, that these tumours have been demonstrated to be due to the presence of a parasitic fungus, called actinomyces or ray-fungus, from its ray-like appearance, and hence the disease is called Actinomycosis.

Soon after the publication of the discovery of the actinomyces or ray-fungus in diseased cattle, the same vegetable parasite was found in man; and it was then seen that the tumours in the bovine species presented great similarity to those found in the human subject, leading to the presumption that it was identically the same disease.

Besides cattle the actinomyces have been found in animals which have suffered from cancerous disease, as the pig, and the dog.

About four years ago Mr. Archibald Park who has carefully studied this subject, called attention to the presence of certain peculiar bodies in these cases of cancer, which he thought differed from true tuberculosis. And as the published accounts in the veterinary literature of the day, of the discovery of actinomyces in a similar disease to this cancer in Europe, agreed with what he observed in the cases in Tasmania, Mr. Park came to the conclusion that the disease in this colony must be the Actinomycosis of Europe.

Previous to his departure to England nine months ago Mr. Park brought me a specimen of one of these osteo-sarcomatous tumours from the lower jaw of a cow. Having made sections we examined them under the microscope, when the distinguishing characteristic club-shaped bodies of the actinomyces or ray-fungus were unmistakably seen, agreeing in all respects with the published accounts of the parasite, thus establishing the fact of the disease in Tasmania being undoubted Actinomycosis.

Having taken with him to England this same specimen, Mr.

Park showed it to the best authorities in London, who confirmed the diagnosis, and were much interested in the discovery.

Sections of the specimens referred to are now on the table for inspection, when members will be enabled to examine by the microscope the peculiar ray-fungus that is associated with the disease in question.

The fungus tufts vary in size from a pin's point to a pin's head, and may be readily seen with the low power of the microscope; but it requires a high power to distinguish the characteristic club-shaped bodies which are arranged in the form of a rosette, or in a radiate manner. When thin sections are cut the larger tufts drop out, leaving round vacant places which give the specimen a reticulated appearance.

Appropriate staining brings out very prominently three different elements which are easily distinguishable under the higher power; first minute granules, or micro-cocci; second, fine threads of mycelium; third, disposed in a radiate manner round the edge of the tufts, larger ovate or club-shaped bodies.

These three elements are not always to be found in the same specimen, and frequently the clubs are not seen, or possibly are not brought out in the staining; but when found they are deemed to be the characteristic element of the darasite. The discovery of this parasitic fungus has been the starting point for many valuable investigations; and it is surprising to find how many obscure diseases there are whose origin may be traced to the presence of this vegetable parasite, and many diseased organs thought to be suffering from tuberculosis have been found to contain the actinomyces, and not the tubercle bacillus.

Our chief interest in the fungus is centred in the fact that identically the same parasite as is found in the lower animals is discovered to be the cause of similar diseases in the human subject. Several well-authenticated cases have been published of undoubted Actinomycosis in human beings having a fatal termination. How these patients became inoculated with this disease it is difficult to say.

It has been shown by experiment that the introduction of the fungus by inoculation into a calf has produced swellings which contained the characteristic clubs of the fungus, thus suggesting that this disease can be transmitted by direct inoculation.

Many similar experiments have been made with a view to prove the transmissibility of this vegetable parasite from animal to animal, and in the majority of cases with a positive result.

There can be no doubt that, in whatever way the actinomyces are taken into the human system, whether by injection, inhalation, or inoculation, there is every liability of their growing and multiplying to the injury of the patient.

The fungus may find entrance by wounds and abrasions of the mucous membrane of the mouth and alimentary system, in a similar manner that other micro-organisms have been proved to enter.

Wherever they find a lodgment they proceed at once to develop, forming mycelial threads and spores; and just as in the case of similar parasites, they set free, in the vicinity of the parent fungus, spores, which give rise to fresh individuals. These spores are carried about by wandering cells, and in this way they give rise to fresh centres of growth. Although it may be well understood how the actinomyces increase and multiply inside the animal system, when once introduced, there is some difficulty in ascertaining the mode of infection from without.

As the most common seats of the disease in cattle are the tongue and jaws, this fact seems to point to lesions in this region as being the mode of entrance of the actinomyces; and where the lungs are alone affected probably the minute fungus has been inhaled. And as it has been observed that the fungus prevails on some pastures to an unusual extent, it is natural to suppose that the animals have acquired the disease through grazing on such sharp-pointed grasses as wound the mucous membrane of the mouth, such as the spear grass, and also briars, gorse, etc.

In whatever way the disease is propagated, there should be no hesitation in arriving at the conclusion that all possible endeavours should be made to prevent the spread of the disease to man, and to lessen the risk of infection by the most obvious methods, such as the destruction of infected animals, and the prohibition of the diseased meat from being used as food. Every animal suffering from the disease is a menace not only to its fellows in the same field, but also to the human beings brought into contact with it.

One may compare this disease to leprosy, which is caused by a microscopic bacillus, and which is highly infectious by contact; and as a practical consequence of this infectivity the leper is kept isolated from others.

Mr. Park, when recently in Queensland, made some inquiries as to the extent to which this cancerous disease prevailed there, and ascertained that cases of human Actinomycosis were frequently met with, more especially on those runs where the cattle were similarly affected. It is believed, upon medical authority, that many of the cases of cancer occurring in Queensland are attributable to the ray-fungus, or in other words are Actinomycosis.

In Queensland, since December of last year, the owners of diseased cattle have been compelled, by regulation of the Public Health Act, to destroy all animals affected with these cancerous diseases; and all animals exposed for sale as food in the market, proved to be diseased, can be seized and destroyed.

On some of the cattle runs it is said that this disease prevails to the extent of about 10 per cent.; and as we obtain some of our meat food from this region, a rigid inspection of all animals arriving by sea is highly necessary.

At Kiama, in N. S. Wales, Mr. Stanley, the Government Veterinarian, at the instance of the Board of Health there, made enquiries into the causes of diseases, tuberculosis and cancer, affecting dairy cattle in that district. In the milking cows he found tuberculosis and Actinomycosis; and tuberculosis in the pigs that were being fed on the milk from those cows which supplied the local butter factory, and which likewise were fed on offal from the slaughteryards.

These facts have been confirmed by Mr. Park, in an examination of portions of the diseased structures taken from these animals given to him by Mr. Stanley. Microscopic slides of these specimens are on the table and can be examined by the microscope, when the actinomyces will be plainly visible.

The presence of actinomyces in these specimens, as well as of the tubercle bacilli, is confirmed by the diagnosis of three medical experts in Sydney, who were called upon to make a microscopic examination of the diseases in question, and who have published their opinions on the subject in the report of the Board of Health of N.S. Wales, dated 9th October, 1890.

The few facts that I have been enabled to bring before the Society this evening show that there is a large field for investigation which has scarcely as yet been entered upon. If the diseases I have been discussing were thoroughly investigated in this colony, and experiments made with a view of testing the extent of the prevalence not only of these, but of other diseases, valuable results would no doubt be shown. And I cannot too strongly urge that this investigation should be made, for, as in the case of tuberculosis and Actinomycosis, other diseases will be found to prevail more extensively than has hitherto been suspected.

A Central Hygienic Institute was recommended by the last Intercolonial Stock Conference, to which all cases of disease amongst animals should be referred from all the colonies. Without some such institution it is not easy to see how information can be obtained as to the extent these diseases prevail in our midst.

A similar institution should be founded in connection with the Health Department of this colony, as modern science now is not content with mere superficial examination, but proceeds with more strict and reliable methods to detect the micro-organisms, which are undoubtedly the active agents in the production of disease.

I cannot conclude these notes better than by quoting the closing words of Professor Robert Koch in an address before the International Medical Congress held in Berlin, August, 1890, in which he had for the first time clearly foreshadowed the result so far of his researches for the purpose of discovering a method of arresting the development of tuberculosis in the animal system, and had expressed a hope that he was on the eve of complete success in obtaining this grand result. He concludes as follows:—"Allow me, therefore, to conclude this address with the expression of a wish that the nations may measure their strength on this field of labour and in war against the smallest, but the most deadly foes of the human race, and that in this struggle for the weal of all mankind one nation may always strive to surpass the other in the successes which it achieves."

WHAT SCIENCE AND COMMERCE MAY GAIN FROM AN ANTARCTIC EXPEDITION.

By A. Morton, F.L.S.

What is to be gained from an Antarctic Expedition is a question so frequently asked that some notice should be taken of it, and an answer framed that, if possible, shall be satisfactory.

Perhaps a reference to what has been done by Arctic Exploration may encourage belief that some benefit would accrue from a properly equipped expedition to the Antarctic region. Observations in the far north have been of incalculable value for the confirmation or correction of scientific theories relating to ocean currents, magnetic deviations, climatology, geographical distribution of plants and animals, and a host of similar subjects; while, as to commerce, it is only necessary to mention the discovery of the White Sea route to Russia, with its consequent trade, the establishment of the Spitzbergen fisheries, and the opening up of new and lucrative whaling grounds in Baffin's Bay and Prince Regent's Inlet, as convincing proofs of the usefulness of many expeditions that promised less in the way of discovery than one to the Antarctic regions. Magnetic researches of the higest value were made during the voyage of Captain Ross to the South Polar regions, and he was able to fix the position of the line of non-deflection of the compass.

Until we know all that can be discovered as to the limit of pack ice, the extent of the Antarctic Continent, the influence of Mount Erebus, the distribution of flora and fauna, and the probabilities of successful whale fishing, there will still be enough to gain, either from a commercial or scientific point of view, to make it worth while to send an expedition to the Antarctic regions. If the *Times* (England), has been correctly reported, it advocates, in preference to an Antarctic Expedition, a fresh attempt to discover traces of Leichhardt in Central Australia. One can scarcely conceive what comparison is possible between the two, though each might be said to be desirable from different points of view, but if they are to be compared, I should be inclined to think that by far the greater advantage, whether for scientific or commercial purposes, lies with the expedition we are considering.

Dr. Neumayer, who for many years has kept the subject of Antarctic Exploration before Germany and the world, comments on the importance of scientific observations inside the Polar Circle, and maintains that for the purpose of discovering those general laws which are necessary as guides and standards in the interpretation of phenomena in climatology and physical geography generally, the South Polar regions are much better adapted than the North. The dictum of Captain Cook, that the ice he met in lat. 71deg. 10min. S. extended to the Pole, and his prediction that no man would venture further than he had done, was set aside successfully by Captain Ross, who penetrated 420 miles to the south of the point at which the great navigator turned back.

With the general results of his voyages, accomplished, be it remembered, without the aid of steam, you are all perfectly familiar. And here let me say that while heartily sympathising with the Geographical Society of Australasia in its efforts to assist the proposed expedition under Baron Nordenskiold, and appreciating the private liberality which has been displayed in the matter, I yet think the sum of £10,000 quite inadequate to produce any great results, or to fit out an expedition that would do much more than has already been done.

Let England and Australasia unite in sending an expedition, so equipped and manned, that failure, if not impossible, shall at least be unlikely, and we may confidently look for results that shall satisfy even the most incredulous as to the wisdom of Antarctic Exploration. Some remarks by Dr. Petermann on "Circumpolar Expeditions," read at a meeting of the Royal Geographical Society, of London, are worth quoting for their applicability to the case in hand:—"Although the Geographical and Scientific world," he says, "would be contented were an Expedition sent out for the sake of Science alone, nevertheless the whale fisheries in the Polar regions are also of great importance, as instanced by the one fact that the American whale fisheries in Behring Straits amounted in two years to the value of 8,000,000 dollars. . . . The English, having the best men, vessels, outfit, and resources, are best fitted to send out an expedition. When the French and American Expeditions, under Captain d'Urville and Lieutenant Wilkes, were sent out to the Antarctic Seas, together with Sir James Ross, it was clearly seen that only the English were quite at home in the Polar elements; they fearlessly went on with their important explorations for three consecutive years, whereas the other squadrons were always beaten back in their attempts to penetrate towards the South Pole. Captain Sherard Osborne, R.N., C.B., an eminent authority on the Polar regions, in a paper read before the Royal Geographical Society of England in 1865, speaks as follows:—"An exploration of the Polar area should always be sent under naval auspices and naval discipline. I have no faith in purely private expeditions; on such a service as this I advocate we need all the resources of a naval dockyard, all the special knowledge collected in various departments—whether in the preparation of vessels, food, raiment, sledges, or equipment—to insure the work being well and safely done. The Navy of England cries not for mere war to gratify its desire for honourable employment or fame, there are other achievements it knows well, as glorious as victorious battle. Upon these points, as well as those of scientific results, it would not be too much to ask for a fraction of the vast sum yearly sunk in naval expenditure, for two small screw vessels and 120 officers and men, out of the 50,000 men annually placed at the disposal of the Admiralty."

This practical advice, coming from such an authority in 1865, is worthy of serious consideration at the present moment. In a letter written by Lady Franklin, dated Madrid, April 6, 1865, the following passage occurs:—"For the credit and honour of England, the exploration of the North Pole should not be left to any other country. It is the birthright and just inheritance of those who have gone through fifteen years of toil and risk in Arctic Seas. The glory that yet remains to be gathered should be theirs."

I should like to say in concluding, for the credit and honour of England and Australasia, the exploration of the South Pole should not be left to any other country, but should be taken up by England, who would, I am sure, be ably and willingly assisted by her loyal Australasian subjects.

DESCRIPTION OF A FERN *(BLECHNUM CARTILAGINEUM)*, NEW TO THE TASMANIAN LIST.

By R. M. Johnston, F.L.S.

By the kindness of Mr. Leonard Rodway I have had the opportunity given me for making a critical examination of a new fern discovered recently at George's Bay by Mr. G. K. Hinsby. Both of these gentlemen are well known as industrious collectors of plants, more especially as regards our little known *Fungi*, and we may hope to gain from them at some early day further valuable additions to our knowledge of the Cryptogamic plants of this island.

The new fern submitted to me by this gentleman might at first sight be readily mistaken for some of the abnormal forms of *Lomaria discolor*, where, at times, several of the pinnæ of the fertile fronds are less contracted or enrolled upon each other; but a closer examination showed that the lines of *sori* were arranged differently, being continuous, and situated close and parallel on each side of the costule, with a membranous indusium opening from under the costule outwards, and thus answering exactly to the generic characteristics of *Blechnum*. This genus is very closely allied to *Lomaria*, but in the latter (whose linear sori are placed nearer the margin, and opening on the inner side next to costule), the sori at length covers the whole of the under surface, and these are themselves often closely enwrapped by the marginal borders of pinnæ which sometimes assumes a cord-like appearance by the extreme flexure. The margin of the species of *Blechnum* about to be described are not so characterised, the sori only at length covering the costule and middle of pinnæ; the margins are not reflexed.

Still further examination showed that the species discovered by Mr. Hinsby was in all respects identical with *Blechnum Cartilagineum*, Swartz, a species hitherto only known from the mainland of Australia, where it is found in similar situations, *i.e.*, along creek-sides and borders of scrubs, in southern Queensland and New South Wales, and in several places in Gippsland, Victoria. The addition of a new *genus* as well as a new *species* to our list of Tasmanian Ferns, is of the very greatest interest, and now that we know of its existence locally, I am convinced it will soon be discovered in other localities, where possibly it has been overlooked or confounded with the everywhere abundant *Lomaria discolor*. I have a vague idea (now that I have examined the George's Bay specimen), that I have seen the same fern on the banks of the North Esk, overhanging the river between Launceston and St. Leonard's. The Launceston botanists might easily verify this matter.

The following is a description of the new species thus referred to :—

Genus Blechnum. Linn.

Rhizome short and thick, or slightly elongated, and horizontal or erect; *fronds* pinnate, deeply pinnatifid, or in some species (not Australian) bi-pinnate or even simple; *pinnæ*, or segments, narrow; *sori* in a continuous line on each side of the costule, with a membranous indusium opening from under the costule outwards, the two sori often at length confluent, concealing the costule (mid-rib.)

B. Cartilagineum. Swartz.

Caudex oblique, densely clothed at the crown with blackish febrillose scales; *stipes*, strong, erect, 4-6in. l., scaly and muricated in the lower part; *frond*, ovate-oblong, 1-2ft. l., 6-9in., br ; *pinnæ*, numerous, erecto-patent, linear, 4-6in. l., ¼-½in. br., narrowed gradually towards the point, the margin finely toothed, dilated and connected at the base, the lower ones not conspicuously smaller than the others; *texture*, coriaceous; *rachis* and both surfaces naked; *veins*, fine; *sori*, in a broad line, *close* to the mid-rib. Hab.—Temperate. Australia (New South Wales, Queensland, Gippsland, Victoria: George's Bay, Tasmania.)

TABULAR LIST INDICATING THE LOCAL HABITATS AND THE GENERAL DISTRIBUTION OF ALL THE KNOWN FERNS, CLUB MOSSES, AND PILLWORTS OF TASMANIA.

By R. M. Johnston, F.L.S.

Since my "Field Memoranda for Tasmanian Botanists" was published sixteen years ago (1874), there has been a considerable alteration in the nomenclature of species as adopted in Hooker's Flora of Tasmania, as well as additions to the list of species then known. Now that our zealous Secretary is about to issue a new and comprehensive Descriptive Catalogue of all the Ferns of the island known at the present time, I have thought it desirable to place on record a revised list of the species, together with as complete a list of the localities of the various species as are known to me, with the desire to aid him in making this portion of his valuable work as complete as possible.

Tasmanian Ferns, Club Mosses and Pillworts.

FILIGES.

Tribe i. Ophioglosseæ.

1. Ophioglossum vulgatum. *Linn.* Adder's-tongue.
2. Botrychum lunaria. *Swartz.* Moonwort.
3. ———— ternatum. *Swartz.* Grape Fern. (B. virginianum.)

Tribe ii. Schizaceæ.

4. Schizea fistulosa. *Labill.*
5. ——— bifida. *Swartz.*

Tribe iii. Osmundeæ.

6. Gleichenia circinata. *Swartz.* Parasol Fern.
7. ———— dicarpa. *R. Br.* (G. microphylla.)
8. ———— flabellata. *R. Br.*
9. Todea barbara. *T. Moore.* (T. Africana.)

Tribe iv. Hymenophylleæ.

10. Trichomanes venosum. *R. Br.* Bristle Fern.
11. Hymenophyllum marginatum. *Hook. et Grev.* Filmy Fern.

12. Hymenophyllum rarum. *R. Br.* Filmy Fern
13. ———————— javanicum. *Spreng.* Filmy Fern. (H. flabellatum.) (H. demissum.)
14. ———————— tunbridgense. *Swartz.* Filmy Fern.
15. ———————— *var.* Wilsoni. *Hook.* Filmy Fern.
16. ———————— Malingii. *Metten.* Filmy Fern.

Tribe v. Cyatheæ.

17. Cyathea medullaris. *S. W.* Black Tree Fern.
18. Alsophila australis. *R. Br.* Prickly Tree Fern.
19. ———— excelsa *var.* Cooperi. *R. Br.*

Tribe vi. Polypodieæ.

20. Dicksonia antarctica. *Labill.* Woolly Tree Fern.
21. Davallia dubia. *R. Br.* Prickly Tree Fern. (Dicksonia.)
22. Lindsayea linearis. *S. W.*
23. ———— trïchomanoides. *Dryana.*
24. Adiantum æthiopicum. *Linn.* Maiden Hair.
25. ———— formosum? *R. Br.* Maiden Hair
26. Hypolepis tenuifolia? *Bernb.*
27. Cheilanthes tenuifolia. *S. W.* Parsley Fern.
28. Pteris falcata. *R. Br.* Ear Fern. (Platyloma, Pellæa.)
29. ——— tremula. *R. Br.*
30. ——— aquilina. *Linn.* Bracken.
31. ——— incisa. *Thumb.* Bat's-wing. (Litobrochia.)
32. ——— comans. *Forst.* (P. Endlicheriana.) (Litobrochia.)
33. Lomaria Patersoni. *Spreng.*
34. ———— vulcanica. *Blume.*
35. ———— discolor. *Wild.*
36. ———— lanceolata. *Spreng*
37. ———— alpina. *Spreng.*
38. ———— fluviatilis. *Spreng.*
39. ———— capensis. *Wild.* (L. procera.)
40. Blechnum cartilagineum. *S. W.*
41. Doodia aspera. *R. Br.* Prickly Doodia.
42. ——— *var.* caudata. *R. Br.*
43. Asplenium trichomanes. *Linn.* Maiden hair spleenwort.
44. ———— flabellifolium. Fan-leaved spleenwort.
45. ———— obtusatum. *Forst.*

46. Asplenium bulbiferum. *Forst.*
47. ———— flaccidum. *Forst.*
48. ———— umbrosum. *J. Sm.* (A. Brownii.) (Athyrium)
49. Cystopteris fragilis. *Bernh.* Little bladder Fern.
50. Aspidium aculeatum. *S. W.* Lady Fern. (Polystichum vestitum)
51. ———— capense. *Wild.* (Polysticum coriaceum.)
52. ———— decompositum. *Spreng.* (Nephrodium.)
53. ———— hispidum. *Sw.*
54. Polypodium australe. *Melten.* (Grammitis.)
55. ———— grammitidis. *R. Br.*
56. ———— punctatum. *Thumb.* P. rugosulum.)
57. ———— pustulatum. *Forst.* (P. Billardiera), (Phymatodes.)
58. Grammitis rutæfolia. *R. Br.* Blanket Fern. Gymnogrammæ.
59. ———— leptophylla. *S. W.* Jersey Fern. Gymnogrammæ.

LYCOPODEÆ.

1. Phylloglossum Drummondii. *Kuze.*
2. Lycopodium selago. *Linn.* Fir Club Moss.
3. ———— varium. *R. Br.*
4. ———— clavatum *var.* fastigiatum. *Linn.*
5. ———— Caroliniana. *Linn.*
6. ———— laterale.
7. ———— diffusum. *R. Br.*
8. ———— densum. *Lab.*
9. ———— scariosum. *Forst.*
10. Selaginella Preissiana. *Spreng.*
11. ———— uliginosa. *Spreng.*
12. Tmesipteris tannensis. *Bernh.*

MARSILEÆ.

1. Isoetes Gunnii. *Braun.*
2. ———— humilior. *Müell.*
3. ———— elatior. *Müell.*
4. ———— Stuartii. *Braun.*
5. Azolla feleculoides. *Lam.* (A. rubra.)
6. Pilularia globulifera. *Linn.*

ABBREVIATIONS.

T.—Tasmania.
W.A.—Western Australia.
S.A.—South Australia.
Q.—Queensland.
N.S.W.—New South Wales.
V.—Victoria.
N.Z.—New Zealand.
E.—Europe.

NOTE.—The last column in the accompanying Table of Distribution refers to the number of the Species under each Group in the preceding list. (R.M.J.)

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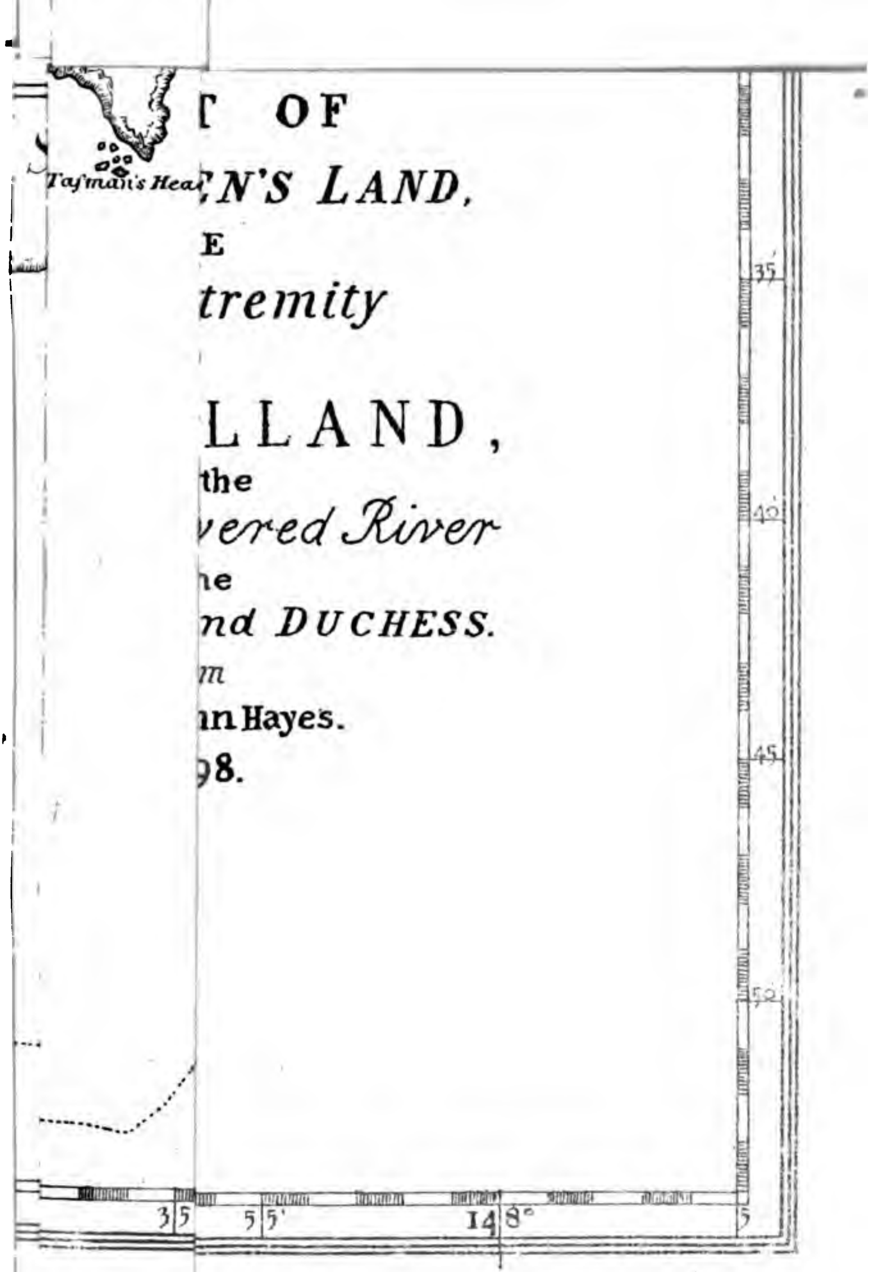

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THE DISCOVERY OF VAN DIEMEN'S LAND IN 1642; WITH NOTES ON THE LOCALITIES MENTIONED IN TASMAN'S JOURNAL OF THE VOYAGE.

BY JAMES BACKHOUSE WALKER.

ABEL Janszoon Tasman was unquestionably one of the greatest, if not the greatest, of the navigators between Magellan, who in the early years of the 16th century first crossed the Pacific Ocean, and Cook, who in the latter years of the 18th practically opened Oceania and Australia to Europe.

Little is known of Tasman's personal history, except that he was born about the year 1602, at Hoorn on the Zuyder Zee, a seaport which produced many another hardy navigator. Tasman has made familiar in our seas the name of one of these fellow townsmen, the Corneliszoon Schouten, who in 1616 doubled the Cape, afterwards called the Horn in honour of the birthplace of its discoverer.

That Tasman's merit has not received due recognition, and that his fame has not been as wide as his achievements deserved, is the fault of his own countrymen. In the 16th and 17th centuries the persistent policy of the Dutch was to conceal the discoveries of their navigators, and suppress their charts, for fear other nations should reap advantage from the knowledge and rival them in the eastern seas. In later times when this motive had lost its force, Tasman's countrymen were strangely indifferent to the honour which their great sailor had won for his native land. Of his second voyage in 1644–in which he explored the northern coast of Australia, and laid down with painstaking accuracy the shores of the Gulf of Carpentaria —we have to this day only meagre hints and the record contained in a sketch map. Of his more famous voyage to the Great Southland in 1642—in which he discovered Tasmania and New Zealand, and made a great step towards solving the vexed problem of the fancied Terra Australis—the journal remained unpublished for more than two centuries. It is true that a short abstract of this voyage was published in Holland late in the 17th century, and was shortly afterwards translated into English, and included in several collections of voyages made by English and French editors, and that Valentyn, in his great work on the Dutch

East Indies published in 1726, gave a more extended account, illustrated by copies of Tasman's maps and sketches. But the journal itself remained practically unknown until a copy of it and of the original sketches and charts was discovered in London in 1776 and purchased for half a guinea. This MS. afterwards came into the possession of Sir Joseph Banks, and he employed the Rev. C. G. Woide, a Dutch clergyman living in London, to make a translation of it. Thirty years later the substance of this translation was printed by Dr. Burney in his "History of Discovery in the South Sea," published in 1814. Woide's MS. is now in the British Museum, and a verbatim copy of the part relating to our island has lately been made by Mr. Bonwick for the Tasmanian Government. In Tasman's own country his original journal remained neglected for more than two centuries, until in the year 1860 it was printed *in extenso* at Amsterdam under the editorship of Mr. Jacob Swart.*

Tasman's expedition was probably the first systematic attempt made by the Dutch to explore the Great South Land. In the early years of the 17th century the Western Coast of Australia had been several times sighted by Dutch Captains. Ships, bound for the Dutch settlements at Batavia, had been driven to the southward by storms, and the resulting discoveries had, therefore, been to a large extent involuntary, or at least accidental. In the year 1642, however, the Governor-General, Anthony Van Diemen, and the Council of Netherlands-India, determined to despatch from Batavia a properly equipped expedition, having for its sole object the discovery of the Great Southern Continent. The instructions to the commander, prepared by their direction, have been preserved. They contain a detailed statement of all that was then known by the Dutch of the geography of those parts, and they prescribe the course that the ships were to pursue. The command of the expedition was entrusted to Tasman, then 40 years old, and the ship *Heemskirk* was assigned to him for the service, with the little fly-boat *Zeehan* as tender. Tasman sailed from Batavia on August 14; reached Mauritius (then a Dutch settlement) on September 5, and sailed thence for the South on October 5. He held a S.E. course until on November 6 he had reached 100deg. E. long. in lat. 49deg. S., without finding any signs of the supposed continent. A council of officers was held, and the chief pilot, Francis Jacobsen, advised that the course should be altered, and that the ships should make for lat. 44deg. S. until 130deg. E. long. was reached, when, if no mainland was meet with, they should sail into 40deg. S. lat., and steer on that parallel until they reached 200deg. E. long. By this course he thought they would be sure to fall in with islands, and having so far solved the problem of the great southern continent, he advised that they should stand north for the Solomon Islands, whence they might shape their course for home. By the middle of November they came to the conclusion that they had passed the extreme limits of the supposed continent, but on the 24th of the month land was seen bearing east by north, distant 10 Dutch miles (40 miles English.) Unlike the invariable low sandy shore which former captains had described as characteristic of the Great Southland, the country before them was mountainous, and clothed with dark forest. Tasman says: "This is the furthest land in the South Sea we met with, and as it has not yet been known to any European we called it Anthony Van Diemen's Land, in honour of the Governor-General, our master, who sent us out to make discoveries. The islands round about, as many as were known to us, we named in honour of the Council of India." They skirted the newly-discovered land, and on December 1 came to an anchor in a bay on the east coast. On December 3 they weighed anchor and sailed north until they reached a point about St. Patrick's Head, from whence they stood away eastward to make new discoveries. After eight days they sighted land, which Tasman called Staten Land, thinking that it might be part of the Southern continent and joined to Staten Land, east of Tierra del Fuego. (When this supposition was shortly afterwards shown to be an error,* the name was changed to that of New Zealand.) After a fatal encounter with the Maoris, Tasman sailed along the west coast of New Zealand to Cape Maria Van Diemen, and thence took a north-east course, discovering Amsterdam and other islands, and after skirting the north coast of New Guinea, he returned to Batavia. In his second voyage in 1644, Tasman again sailed from Batavia and explored the west, north-west, and north coasts of Australia, the Gulf of Carpentaria, and the south coast of New Guinea. Thus in the two voyages, though he left the question of the existence of a southern continent still unsolved, he had made the first complete circumnavigation of Australia and New Guinea.

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* Journaal van de reis naar het onbekende Zuidland in den jare 1642, door Abel Jansz. Tasman; medegedeeld door Jacob Swart. Amsterdam, 1860.

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* By the voyage of Brouwer round Cape Horn in 1643.

We may now turn our attention to identifying the parts of the coast of our island which were sighted by Tasman. The difficulty is that his longitudes are very uncertain, and his latitudes, though less variable, do not agree with modern observations, being in general some 9 or 10 miles too southerly.* His longitudes are quite hopeless. Their uncertainty is shown by the fact that he makes a difference of 3 deg. 40 min. between the west coast and Frederick Henry Bay, while the true difference is only 2 deg. 48 min.—an error of 52, or nearly a degree in that short distance. Many of his positions are stated to have been estimated by reckoning, and we know that in those days the ascertainment of longitude by observation was always very uncertain.

It is generally stated that the first land sighted by Tasman was near Point Hibbs, and his little chart of Van Diemen's Land appears to favour this opinion, but an examination of his journal leads us to a different conclusion. From the entries in the journal it is evident that his position on November 24, when he first saw the land, is not laid down on the chart at all. The latitude entered for noon that day is 42 deg. 25 min. As the weather was clear this was probably the observed latitude, and making allowance for the usual error we may place it some miles more to the north, say 42 deg. 20 min. or 42 deg. 15 min. From noon he sailed four hours E. by N. before he sighted land bearing E. by N. 40 English miles distant. When evening fell some three hours later this course would have brought him to a latitude a little to the northward of Cape Sorell (42 deg. 12 min.) This position would agree very well with his description of the land as he saw it on that evening, and which he describes as "very high." "Towards evening we saw three high mountains to the E.S.E. and to the N.E. We also saw two mountains, but not so high as those to the southward."

Flinders in his circumnavigation of the island identified the two mountains to the N.E. as those named by him Heemskirk and Zeehan after Tasman's ships. They are visible at about 30 miles distance. Now with Heemskirk and Zeehan bearing N.E., at a distance of say 20 miles, Mount Sorell, the southern peaks of the West Coast Range, and the Frenchman's Cap, would be nearly E.S.E., while the centre of the West Coast Range seen over the low sandy foreshore north of Macquarie Harbour would fit Tasman's description of the very high land in front of him. If the land near Point Hibbs had been first sighted, Mount Heemskirk would have been at least 50 miles distant, and not visible. It is therefore probable that the first land seen by the Dutch navigator was the mountainous country to the north of Macquarie Harbour. Without further observations the point must remain doubtful, but when we get the much-needed and long-expected Admiralty survey of the West Coast it will doubtless be possible to fix precisely the spot of Tasman's landfall.

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* This conclusion is reached by a comparison of the latitudes shown on his chart for his anchorage on the east coast, for Maria Island, the Friars, and Maatsuyker Island. On the other hand he gives the latitude of the point where he approached close to shore as 42 deg. 30 min., the true latitude of Point Hibbs being 42 deg. 38 min.

When the shades of evening fell over the strange shore they had just discovered it was deemed prudent to run out to sea during the night, and when morning broke the land was far distant. The breeze had died away, and it was noon before they had enough wind to run in again towards the shore. By 5 in the evening they were within 12 miles of the land, and they kept on their course until within one Dutch mile (4 English miles) of what was without doubt Point Hibbs.

This was the opinion of Flinders, than whom there could be no higher authority on such a question, and Tasman's sketch, rough as it is, seems conclusive. Point Hibbs is there laid down as an island, but its distinctive form—unlike any point lying to the northward—is correctly shown.[*]

The ships stood out to sea again and sailed south-east in thick, foggy weather, in which only glimpses of the coast were obtained. Tasman took some of the high headlands and mountains about Port Davey for islands, calling them De Witt and Sweers Islands. Then he rounded the South West Cape, and named the Maatsuyker Islands, passing close to a small island about 12 miles from the mainland which looked like a lion, and which was indentified afterwards by Flinders as the rock named by Furneaux the Mewstone. Thence he passed between the mainland and a rock which he named Pedra Branca[†] (White Rock) from its resemblance to Pedra

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[*] The only difficulty in reconciling the positions of the two days (Nov. 24 and 25) lies in the fact that the difference of latitude given in the journal is 5 min. only. The difference of latitude between Cape Sorell, where we suppose him to have been on the first evening, and Point Hibbs, where he certainly was on the second, is 26 miles. The discrepancy may, however, be accounted for. On the second day they had southerly wind and thick weather, and probably got no observation. They had been standing off and on for 24 hours, and currents unknown to them would probably lead to error in estimating their position. The probability of error in Tasman's latitude is increased by the fact that he makes the latitude 42 deg. 30 min. instead of 42 deg. 38 min., the error being too northerly instead of too southerly, as usual.

[†] Known to our fishermen as "Peter's Bank."

Branca off the coast of China, and sailed past the entrance of D'Entrecasteaux Channel without entering it, though in his chart he marks an opening in the coast. Rounding the Friars (which he called Boreels Isles) on November 29 he bore up for a large bay, intending to anchor there. When he had almost reached his intended anchorage* a heavy storm arose, and he was driven out so far to sea that next morning he could hardly discern the land. It was from this incident that Storm Bay got its name. When the wind moderated he continued his easterly course, and rounding Tasman's Island (the Pillar) he turned northward along the east coast of Tasman's and Forestier's Peninsulas until, on December 1, an hour after sunset, he came to an anchor in a good port in 22 fathoms, the bottom fine, light-grey sand. "Wherefore," says Tasman piously, "we ought to lift up thankful hearts to Almighty God." The position of this anchorage, as shown in Tasman's chart, is north-west of the rocky islet now called Green Island, just north of the basaltic cliffs of Cape Frederick Henry.

On December 2, early in the morning, the boat was sent to explore, and entered a bay a good 4 miles to the north west (Blackman's Bay). The boat was absent all day, and returned in the evening with a quantity of green stuff which was found fit to cook for vegetables. The crew reported that they had rowed some miles after passing through the entrance to the bay (now known as the Narrows). They had heard human voices, and a sound like a trumpet or small gong (probably a cooey), but had seen no one. They saw trees from 12 to 15 feet round, and 60 to 65 feet up to the first branch. In the bark of these trees steps had been hacked with a flint for the purpose of climbing to the birds' nests. From the steps being five feet apart they inferred that the natives were either very tall†, or had some unknown method of climbing. The forest was thin and unencumbered by scrub, and many of the tree trunks were deeply burnt by fire. In the bay were great numbers of gulls, ducks, and geese. At various times during the day both the boats' crews and the people on board the ships had seen smoke rising from different points on shore, "so that without doubt in this place must be men, and these of uncommon height."

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* The anchorage he aimed at was the same where Furneaux anchored in 1773, and which he named Adventure Bay.

† The early navigators had a fixed idea that these southern lands were inhabited by giants. At the Three Kings, north of New Zealand, Tasman describes the men they saw walking on the shore as being of gigantic stature.

The next day (Dec. 3) the boats went to the south-east corner of the bay in which the ships were anchored, in order to get fresh water, but, though they found a lagoon, the shore was so low that the waves had broken through, and the water was too brackish for use. The wind blew strongly from the east and south-east, and in the afternoon, when they again tried to effect a landing with the boats, the sea ran so high that one boat was obliged to return to the ship. The other larger boat, under the command of Tasman himself, made for a little bay to the W.S.W. of the ships, but the sea was too rough to allow of landing. The carpenter, Peter Jacobsen, volunteered to swim ashore with a pole on which was the Prince's flag. He planted the flag-pole in the ground on the shore of the bay, and thus Tasman took possession of our island for the Dutch.

Next morning at daybreak (Dec. 4), the storm having subsided, and the wind blowing off shore, they weighed anchor and stood to the northward, passing Maria Island and Schouten Island, so named by Tasman after his fellow-townsman of the good port of Hoorn.

On the following morning (Dec. 5) he took his departure from a high round mountain (St. Patrick's Head) and stood away to the eastward to make fresh discoveries.

Of the localities associated with the discovery of this island, the one round which the chief interest centres is Frederick Henry Bay and its neighbourhood. The name has been dislocated from its rightful position on the map, and has been transferred to another part of the coast, where it is now fixed by long usage. Tasman never saw what is now popularly known as Frederick Henry Bay. The bay to which he gave the name of the Stadtholder of Holland was in the immediate vicinity of his anchorage on the north-east coast of Forestier's Peninsula. Its exact locality the records of the voyage leave a little doubtful. The journal contains no names of places, but the account of the planting of the flag would lead to the inference that he gave the Prince's* name to the bay in which his ships lay at anchor, on the shore of which the Prince's flag was set up, and which is now known as Marion Bay. The charts, however, lead rather to the conclusion that it is the inner port or arm of the sea (now Blackman's Bay) which is the true Bay of Frederik Hendrik. The copy of the map in Burney leaves the point doubtful, the name being written on the land between the two ports. But in the chart as reproduced by Vallentyn, and stated to have been copied by him from the original journal, the name is distinctly written in Blackman's Bay. On the whole, therefore, it seems probable that this is the Frederik Hendrik Bay of Tasman.

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* Prince Frederik Hendrik of Orange was Stadtholder of Holland from 1625 to 1647. He was the grandfather of William of Orange, afterwards William III. of England.

The eastern shore of Forestier's Peninsula is wild and rugged, and scarcely known except to the hardy fishermen who, in their trips northward along the coast, fish in its quiet nooks, or run for shelter into the beautiful inlet of Wilmot Harbour. With the exception of a solitary shepherd's dwelling on the shore of this harbour—locally known as Lagoon Bay—the eastern part of the Peninsula is uninhabited, and so difficult of access that it is seldom visited. In the early part of 1889 I had an opportunity of thoroughly exploring a locality which must always be of interest as the spot where the sailors of the great Dutchman first set foot on the island which bears his name.

Our party—which included my friend Mr. R. M. Johnston—left East Bay Neck in a fishing-boat to camp at Chinaman's Point just within "The Narrows," or entrance of Blackman's Bay. During the time of our ten days' camping we cruised in our boat over the great bay outside, seeing the coast from the point of view which Tasman occupied when the *Heemskerk* lay at anchor off rocky little Green Island. We could thus realise the scene, unaltered after two centuries and a half, which presented itself to the old navigator when he caught his first near view of the picturesque shores of this outpost of the Great South Land, the mysterious continent of his search. To the south stood the jutting basaltic columns of Cape Frederick Henry—a lesser Cape Raoul—backed by the high round of Humper's Bluff. Thence his eye travelled northward round twenty miles of curving shore, its white beaches broken here and there by dark cliffs and rocky points. On the north, beyond the long stretch of white sand barring Blackman's Bay, rose steep-wooded hills, buttressed at their eastern end by the abrupt mass of Cape Bernier, thrusting its almost precipitous slope into the ocean, and flanked by the hills of Maria Island, shutting in the great bay on the north-east. The coast view from the offing is fine, but if the visitor wishes to appreciate fully the picturesqueness of the shore, and to identify the spots mentioned in the quaint old Dutch journal, he must be prepared for some rough scrambling on the Peninsula itself. The country inland is poor, almost without water, covered with thin gum forest, scrub, and meagre grass. It is only the shore that is interesting. The rocky headlands, cliffs, and islands, against which the ocean dashes, are rent and scarred by sudden fissures and chasms, into which the waves rush roaring and tumbling. Between the points lie a variety of lovely bays; now a broad white beach with long rollers of breaking surf, now a rocky nook, now a quiet and sheltered cove.

Our centre of observation was the camping ground within The Narrows, from whence we looked out over the broad expanse of Blackman's Bay. This extensive inlet or arm of the sea is shallow and full of shoals and sandbanks, which make the navigation even of a boat dangerous to the inexperienced. It is shut in from the sea by a long tongue of land and by shoals, leaving only a small outlet very appropriately called "The Narrows," through which the tide rushes with great force. Early on the first morning after the ships had come to an anchor the two boats, under the command of Pilot Francis Jacobszoon, rowed through this narrow inlet to explore the new-found country. The pilot's description of the watering places where the water trickled so slowly that they could with difficulty fill a bowl is thoroughly characteristic of the eastern shores of Blackman's Bay. In the evening Pilot Jacobszoon returned on board with his collection of strange vegetables, and his report of the well-wooded country, the great trees scarred by fire, with marks on their bark of the steps of gigantic climbers, whom they had not seen, but whose mysterious voices they had heard.

The various localities mentioned in Tasman's journal were easily reached from our camp. Outside "The Narrows" the shore rises in high cliffs, at the foot of which a broad rocky shelf affords access to little nooks, which, in the early days of the colony, were the sites of stations for bay whaling, and are still known as Gardiner's and Watson's Fisheries. Some two miles from The Narrows is Cape Paul Lamanon. A fishing excursion to the neighbourhood gave me an opportunity of landing on the Cape. It is a low point, the soil of which is stony and arid, covered with small timber and rough scrub. From the Cape a short walk took me to the little cove marked on the maps as Prince of Wales Bay. It was on the shore of this little cove (cleene bochtien), situated to the west-south-west of Tasman's anchorage, that the Dutch flag was planted two centuries and a half ago. The shores of the bay on each side of the entrance are rocky and broken, but further in the rocks give place to a beach of large grey shingle. As you advance along the shore up the bay the banks of shingle on each side curve into two horns shelving out towards the centre of the bay, and forming a bar extending nearly the whole way across the entrance to the inner cove. Within the bar of shingle lies enclosed a lovely cove, its quiet waters fringed by a curved beach of great smooth stones. On either hand it is shut in by steep banks crowned with dark forest, and from the steep grey beach at the bottom of the cove a wooded valley runs inland. Standing just outside the shingle bar at the entrance to this inner harbour it needs no great effort of the imagination to call up the scene on that 3rd December, 1642. Away out in the offing, near yonder grotesquely shaped Green Island, the high-pooped old Dutch ships lie at anchor. The wind is blowing fresh from the eastward, and two boats put off from the ships and stand for the shore. The wind increases to half a gale, and while the smaller boat runs back to the ships the larger boat changes her course and heads for this bay. As she approaches we can see on board of her Tasman himself, and some of the *Heemskerk's* officers; Gerrit Janszoon, the master; Abraham Coomans, the supercargo; and Peter Jacobszoon, the carpenter. The surf breaks violently on the shingle, and Tasman finds that to land in such a sea is impossible without great danger of wrecking the boat. Must he, then, after all, sail away without taking formal possession of the newly-discovered land? There is a short deliberation as the rowers rest on their oars, and then the carpenter, Jacobszoon, hastily throws off his clothes, plunges into the sea, and, pushing his flag-pole before him, strikes out for the shore. Making his way through the breaking surf he lands on the shingle beach, and there, at the foot of the steep slope, where four stately gums stand in a crescent on the hill side, he plants the flag of the Prince Stadtholder. We can imagine the cheer which greeted the raising of the flag as the carpenter, in the name of the States-General, thus took possession of the new territory of the Great South Land. Then the boat is brought as close in to the shore as possible, the carpenter swims out to her again through the surf, and they return on board the *Heemskerk*. "Leaving the flag," says Tasman, "as a memento to posterity and to the inhabitants of the country, who, though they did not show themselves, we thought were not far off, carefully watching the proceedings of the invaders of their territory."

Another place of interest on this coast to which we paid a visit is Wilmot Harbour, locally known as Lagoon Bay, a deep cove to the south of the basaltic promontory of Cape Frederick Henry. Here is the one solitary dwelling on this part of the Peninsula. It is probably the only locality which has altered much in appearance since the time of Tasman. Everywhere else the wild bush remains untouched, but here is green pasture, and even a small cornfield or two. The southern headland of the harbour is one of the wildest and most picturesque of spots. Standing on the grassy surface of its narrow extremity, which is rent into chasms and fissures, you look down upon the sea breaking tumultuously into a deep gulf below. On the other side of the gulf, to the south, there rises abruptly out of the water the grassy and wooded steep of a headland, with bold outline like Mount Direction. Turning to the north you see at your feet two rocky islands, their precipices crowned with wood and scrub, the waves heaving and swirling round their bases. Across the mouth of the harbour stand the basaltic columns of Cape Frederick Henry—a lesser Cape Raoul. Beyond, over outlying rocks and islets, is the place of Tasman's anchorage; while in the distance, twelve or fifteen miles off across the sea, loom the peaks of Maria Island.

On our return we took the way of the Two Mile Beach (the North Bay of the maps). Behind the sandhills at the back of the beach lies a large lagoon, which discharges its brackish waters by a narrow sandy channel at the south corner of the beach. This is the spot where Tasman's boat's crew landed—on the morning after their exploration of Blackman's Bay—to search for water, and where they found that the sea breaking through into the lagoon had made the water too brackish for use. The spot is easily identified from Tasman's description, and is probably hardly altered in appearance by the lapse of two centuries and a half. The beach is a fine stretch of broad white sand two miles long, on which the great ocean rollers break splendidly, and is backed by a line of low sandhills, behind which lies the lagoon.

For more than a century after Tasman anchored off Green Island no navigator ventured to follow him into the stormy seas that wash the dark cliffs of the Great South Land. The first of the moderns who sighted the coast of Van Diemen's Land was the French captain Marion du Fresne in 1772. Marion made the West Coast a little to the south of Tasman's landfall, and, following almost the same course as the earlier navigator, his ships, the *Mascarin* and *Marquis de Castries*, on the 5th March, 1772, anchored at a spot somewhat to the north-west of the *Heemskerk's* anchorage in 1642. Marion took this to be the Frederick Henry Bay of Tasmania, but, as we have already seen, this was almost certainly an error, and since the visit of the *Mascarin* the outer bay, as distinguished from the inner, has borne on the charts the more appropriate designation of Marion Bay. The description in the narrative of the voyage* is not sufficiently exact to enable us to determine the precise spot where the French landed, but it appears to have been on the Two Mile Beach (North Bay of our present maps). On this beach it was that the aborigines of Tasmania first came into contact with Europeans. The meeting was an ill-omened one. The blacks resisted the landing, and attacked Marion's party with stones and spears. The French, in retaliation, fired upon them, killing one man and wounding others. The ships lay at anchor in the bay for six days, during which the French explored the country for a considerable distance, searching for fresh water and timber for spars, but they saw nothing more of the natives after this first fatal encounter. Being unable to find either good water or timber suitable for his needs, Marion sailed on March 10 for New Zealand, where he met his death in a treacherous attack on his people by the Maoris.

The next navigator who visited the Tasmanian coast was Captain Tobias Furneaux, Cook's second in command on his second voyage of discovery. It is to Furneaux's blunders that the confusion respecting Frederick Henry Bay is due. The two ships, the *Resolution* and the *Adventure*, were separated by a storm in latitude 50° south, between the Cape and Australia. Cook, in the *Resolution*, kept on his course for New Zealand; Furneaux, in the *Adventure*, being short of water, bore up for the land laid down by Tasman as Van Diemen's Land. On March 9, 1773, Furneaux sighted the land at a point which he took to be Tasman's South Cape. The point was, in fact, South West Cape, and from this initial error the whole course of subsequent blunders arose. From South West Cape he sailed eastward intending to make Tasman's anchorage in Frederick Henry Bay. Reaching the South Cape, he mistook it for the Boreel Islands, south of Bruny, and mistook the entrance of D'Entrecasteaux Channel for Tasman's Storm Bay. The south point of Bruny he mistook for Tasman's Island (the Pillar), and called it Tasman's Head. Rounding Bruny Island he stood north, under the impression that he was sailing along the east coast of Van Diemen's Land, and in the evening came to an anchor in a bay of which he says—"We at first took this bay to be that which Tasman called Frederick Henry Bay, but afterwards found that his is laid down five leagues to the northward of this." Furneaux named his anchorage Adventure Bay, the point to the north he called Cape Frederick Henry—believing that Tasman's Frederick Henry Bay lay to the north of this cape—and the opposite shore of Tasman's Peninsula he laid down on his chart as Maria's Isles. After five days' stay in Adventure Bay, he sailed out and rounded the Pillar, under the impression that he was rounding the south point of Maria Island. Thence he proceeded north as far as the Furneaux Group, and then bore away for New Zealand to rejoin Cook.

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* Nouveau voyage à la mer du Sud, commencé sous les ordres de M. Marion Rédigé d'apres les journaux de M. Crozot (Paris, 1783). Through the exertions of Mr. McClymont and Mr. A. Mault, Marion's charts of Van Diemen's Land have been discovered in Paris, and *fac similes* of them obtained. See the Society's Papers and Proceedings for 1889.

Cook, on his third voyage, cast anchor in Adventure Bay on January 24, 1777, without detecting Furneaux's mistake or correcting his charts.

In 1789, Captain J. H. Cox, in the brig *Mercury*, anchored in the strait between Maria Island and the mainland, but, misled by the charts of Furneaux and Cook, never suspected that he was within a few miles of Tasman's Frederick Henry Bay.

In April, 1792, Admiral D'Entrecasteaux, with the ships *Recherche* and *Esperance*, sighted the Mewstone and bore up for the mainland, intending to make Cook's anchorage in Adventure Bay. Through an error of his pilot, instead of rounding Bruny Island, he stood to the west of it, and found that he was not in Adventure Bay, but in the entrance of the Channel, which he (like Cook) believed to be the Storm Bay of Tasman. D'Entrecasteaux explored the channel which bears his name, ascended our river, which he named Rivière du Nord, and explored the wide bay to the north-east, which he named Baie du Nord. This bay he thought, communicated with Tasman's Frederick Henry Bay on the east coast, and under this impression the land which Cook had erroneously laid down as Maria Island he named Ile d'Abel Tasman.

In 1794, Capt. John Hayes, in the ships *Duke of Clarence* and *Duchess*, visited Storm Bay—although the name does not appear on his charts.* He evidently had only Cook's chart, since he places Adventure Bay, Tasman's Head, and Maria's Iles as they are laid down by Cook. Capt. Hayes re-named all the other localities in Storm Bay, and it is to him that we owe the name of the River Derwent. The Baie du Nord of D'Entrecasteaux he called Henshaw's Bay.

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* See Mr. A. Mault's paper, with *fac simile* of Hay's chart, in the Society's Papers and Proceedings for 1889.

In December, 1798, Flinders and Bass, in their first circumnavigation of the Island in the *Norfolk*, sailed up Storm Bay and explored and surveyed the Baie du Nord of D'Entrecasteaux. Flinders says that he was at the time quite ignorant that this bay had ever been entered before, and, misled by the errors of Furneaux and Cook, he laid it down on his first sketch chart* as Frederick Henry Bay.

In January, 1802, the French discovery expedition under Admiral Baudin, in the ships *Géographe* and *Naturaliste*, arrived in D'Entrecasteaux Channel. During a stay of some weeks they completed the surveys of Admiral D'Entrecasteaux, and explored and surveyed the Baie du Nord. They then sailed for the east coast and anchored their ships in the passage between Maria Island and the mainland. From this point Freycinet, Baudin's lieutenant, made the first thorough examination of Tasman's Frederik Hendrik Bay. He explored it as far as East Bay Neck, and was thus enabled to correct the mistakes of former navigators. He found that D'Entrecasteaux had been mistaken in supposing that there was a channel between Frederick Henry Bay and the Baie du Nord, and that the supposed Ile d'Abel Tasman was a double peninsula, to which he gave the names of Forrestier's and Tasman's Peninsula (Presqu'ile d'Abel Tasman). He also proved that Flinders† had been in error in applying the name Frederick Henry to the Baie du Nord. The charts of Baudin's expedition, constructed by Faure, were the first to show this coast accurately: in them for the first time the outer port was laid down as Baie Marion, and the inner one as Baie Frédérick Hendrick.

Many years later, after his liberation from his long Mauritius captivity, Flinders came to write his "Voyage to Terra Australis." He had then had the opportunity of comparing his own surveys of fifteen years before with the French charts, and correcting his errors. In his atlas, therefore, the Baie du Nord is correctly named

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* See Mr. Mault's paper and *fac simile* of chart, cited above.

† Peron's narrative of Baudin's voyage was published in 1807. The author had, therefore, the opportunity of comparing Flinders' charts which were seized at the Mauritius in 1803.

North Bay, and the name of Frederick Henry Bay is restored to its proper place on the east coast; though Flinders applies it to the outer port and not to the inner which bears the name on Tasman's map.

The original error of Furneaux, perpetuated as it was by the high authority of Cook and of Flinders' first chart, had obtained too firm a hold to be displaced. On all the early English charts the Baie du Nord was laid down as Frederick Henry Bay, and by this name it is alluded to in all the early records; in Collins' despatches;[*] in Knopwood's diary,;[†] as such it continued to be known to the early settlers, and so it is universally known to the present day.

After the publication of Flinders' atlas some of the early map-makers endeavoured to restore the names to their proper localities. Thus in a chart of Van Diemen's Land compiled by G. W. Evans, Surveyor-General, and published in London in 1821, and also in a chart published in London by Cross in 1826, North Bay is correctly placed, and the name Frederick Henry is in the first map applied to the outer bay, and in the second more correctly to the inner one. In Assistant Surveyor-General Scott's map published in Hobart by Ross in 1830, the name Frederick Henry appears in North Bay, but in Arrowsmith's map published in London in 1842, the alternative names are given, viz.:—Frederick Henry Bay *or* North Bay; while the name Frederick Henry also appears correctly in the inner bay to which it was originally applied by Tasman. In all modern maps, however, D'Entrecasteaux' name of North Bay has been most inappropriately transferred to what I have described as the Two Mile Beach, on the east coast of Forestier's Peninsula.

The Fredrik Hendrik Bay of Tasman is now known as Blackman's Bay. On early maps the name of Blackman's Bay is applied sometimes to the Two Mile Beach, and sometimes to Wilmot Harbour. By what freak of the map-makers of our Survey Department these names have been shuffled about so oddly I am quite at a loss to imagine.

The names as they stand are perhaps now too firmly established to be changed at once. But I would venture to offer to the Lands Office two suggestions:—

(1) As there is already a Cape Frederick Henry on the east coast of Forestier's Peninsula, which rightly marks Tasman's anchorage, a more appropriate name

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[*] King to Collins, January 8, 1805; Collins to King, June 24, 1805

[†] Knopwood's diary, February 12, 1804.

should be given to the other Cape Frederick Henry, forming the north point of Adventure Bay on Bruny Island. Let the last-mentioned Cape bear the name of its discoverer, and be rechristened "Cape Furneaux." This would remove one source of misapprehension.

(2) Though it may not be possible at once to restore the correct names of the bays, yet they may be indicated without causing confusion, and indeed with distinct advantage to the popular apprehension of our history. In all future maps let the names originally given be added in brackets. D'Entrecasteaux Baie du Nord would then appear as "Frederick Henry Bay *or* North Bay," and in Blackman's Bay would also be added "Fredrik Hendrik's Bay of Tasman."

Thus to perpetuate the remembrance of the landing-place of Tasman would be a graceful act of justice to the memory of the great seaman who, two centuries and a half ago, first circumnavigated Australia, and has given his illustrious name to this fair island of Tasmania.

18 1892

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ROYAL SOCIETY.

APRIL.

The first monthly meeting of the session of 1891 was held on Tuesday evening, April 21. The President His Excellency Sir R. G. C. Hamilton, K.C.B., presided, and there was a good attendance of Fellows. Lady Hamilton and a number of ladies were also present.

CORRESPONDING MEMBER.

Rev. F. R. M. Wilson, Kew, Victoria, was elected a corresponding member.

ANTARCTIC EXPEDITION.

Mr. MORTON stated that he had received a list from the hon. secretary of subscriptions in aid of the Antarctic expedition, showing that the following sums had been subscribed:—Royal Geographical Society of Australasia (Victorian Branch), £200; Mr. J. S. Gotch, of Messrs. Gordon and Gotch, £100; Professor Kernot, £100; E. C. Merewether (President N.S.W. Branch of Royal Geographical Society of Australasia), £100; Royal Society of Tasmania, £50; Royal Society of Victoria, £100; Dr. Agnew, £100. He (the Secretary) had placed Dr. Agnew's name on the list as having subscribed from Tasmania.

His EXCELLENCY said that a few days ago he had received a cablegram from Baron Von Mueller, stating that New South Wales had placed £2,000 and Queensland £1,000 on their annual estimates in aid of the proposed Antarctic exploration. He asked whether the Tasmanian Government would place £500 on the estimates for the same purpose. He had handed the cablegram to Ministers, but had not as yet received any answer.

GIFT FROM DR. AGNEW.

The SECRETARY said that the Society was indebted to Dr. Agnew for another munificent gift. Some years ago back the Society obtained 12 parts of the Birds of Asia, by J. Gould, F.R.S., a rare and expensive work. The complete work consisted of 35 parts and Dr. Agnew had instructed him (Mr. Morton) to complete the set, which he had done through Trübner and Co., of London, at a cost of £75.

His EXCELLENCY referred in appreciative terms to the interest Dr. Agnew had shown in the Society, and the practical effect he had given to that interest by many valuable presents. He asked them to join with him in carrying by acclamation a hearty vote of thanks to Dr. Agnew. (Applause.)

AUSTRALASIAN SCIENTIFIC ASSOCIATION.

Mr. MORTON said—Your Excellency and members of the Council of the Royal Society of Tasmania; having been appointed in conjunction with Mr. C. H. Grant as a delegate of the Royal Society of Tasmania to the meeting of the Australasian Association for the Advancement of Science, held at Christchurch, New Zealand, during the week commencing January 15, 1891, it becomes my duty, in the absence of Mr. Grant, who is out of the colony, to report to you on matters relating to the meeting. At the first general committee meeting, held at the Canterbury College, January, 15, Sir James Hector, K.C.M.G., President-elect for 1891, proposed that His Excellency Sir R. G. C. Hamilton, K.C.B., be the President for the fourth meeting, to be held at Hobart in 1892; a motion that was enthusiastically received and unanimously adopted. The other officers then elected for the Tasmanian meeting were Mr. James Backhouse Walker as local treasurer, and your delegate as general secretary. The New Zealand meeting, which lasted seven days, was a great success. The sections one and all were largely attended, and the deepest interest was taken in the many valuable papers read. The members attending the New Zealand meeting were most hospitably entertained by the Christchurch residents. The thanks of the association are largely due to Professor F. W. Hutton, F.G.S., the general secretary, for the New Zealand meeting, for the great attention paid by him to all members attending the meeting. As soon as possible after my return the Tasmanian Local Executive Committee, consisting of the Hon. J. W. Agnew, M.D., Messrs. James Barnard, C. H. Grant, R. M. Johnston, J. B. Walker, and myself, had a meeting with the object of taking the necessary steps to appoint Presidents, Vice-Presidents, and Secretaries to the different sections and to arrange other matters for the fourth meeting. The committee decided that the 1892 meeting shall commence on Thursday, January 7, 1892. The rules are that presidents of the various sections must reside out of the colony in which the meeting is held; vice-presidents and secretaries are to be residents of the colony. It is gratifying to know that the presidents in nine sections out of ten are already appointed:—Section A, Astronomy, Mathematics, Physics, and Mechanics, Professor W. H. Bragg, M.A., Professor of Mathematics, University of Adelaide. Section B, Chemistry and Mineralogy, Mr. W. M. Hamlet, F.C.S., F.I.C., Government Analyst of New South Wales. Section C, Geology and Palæontology, Mr. C. S. Wilkinson, F.G.S., Government Geologist of New South Wales. Section D, Biology, Professor W. Baldwin Spencer, M.A., Professor of Biology, Melbourne University. Section F. Economic Social Science and Statistics, Mr. R. Teece, F.I.A., of Sydney. Section G, Anthropology, Rev. Lorimer Fison, Queen's College, University, Melbourne. Section H, Sanitary Science and Hygiene, Professor W. H. Warren, M.I.C.E., Professor of Engineering, University of Sydney. Section I, Literature and Fine Arts, E. E. Morris, Professor of English, German, French languages, and Literatures, Melbourne University. Section J., Architecture and Engineering, Mr. C. Napier Bell, C.E. of New Zealand. Section E. is therefore the only section without a president, but His Excellency Sir William Macgregor, Governor of New Guinea, has been asked to accept the presidency of this section, and his reply is daily expected. Satisfactory arrangements have been made with all the Australian railway authorities and steamship companies for members travelling to attend the meeting. The Railway Commissioners will allow all members to travel at single fare for double journeys, and the steamship companies 20 per cent. off ordinary excursion rates. The Tasmanian Government and the Mount Bischoff Railway Co. have agreed to grant similar concessions to those granted on the New Zealand railways, viz., members to be allowed to travel half single fares during the months of January and February. The Municipal Council have generously placed the large room, and as many other rooms as can be spared, of the Town Hall buildings at the disposal of the association, and the Chamber of Commerce have consented to do likewise with their room. A large gathering from all the colonies is expected, and numerous promises of papers in different sections have already been received. From the outlook at present the fourth meeting of the Australasian Association bids fair to be the most successful yet held.

His EXCELLENCY said that when asked to become President of the Australasian Association for the Advancement of Science he at first refused, because he thought the position was one which ought to be held by someone who was distinguished in some branch of science. The matter, however, was again pressed upon him, and he was told from several quarters that it was desirable from many points of view that he take the position. It was a position which anyone might be proud to hold, and his hesitation in accepting it only arose from his thinking he could hardly be able to do justice to its duties. When he found, however, that it was the desire of the association that he should become President, he at once accepted, and having accepted, he meant to do everything in his power to make the meeting a great success. The first thing he did was to try to secure the presence of Professor Huxley, who some time ago contemplated visiting Australia. He wrote to Professor Huxley and had received a reply, in which the Professor said that he had very pleasant recollections of Tasmania 43 years ago, and it would interest him very much to re-visit the colony and compare the present with the past, but he regretted that the state of his health prevented him from accepting the invitation. He (President) was sure that they all regretted that Professor Huxley was unable to come, and that ill-health was the cause. Mr. Morton, in his report, had given a most satisfactory list of the Presidents and Vice-Presidents, and had mentioned the name of Sir Wm. McGregor as one who had not yet signified his intention to be present. He had written to Sir William, and pointed out to him the importance of the meeting. He had invited Sir William to be his guest at Government House, and he hoped he would come and lend that *eclat* which his great reputation and the great work he had done in New Guinea would bring to the meetings of the association. He had also written to two gentlemen in England, distinguished in the walks of science, asking them to come out to Tasmania and be his guests on the occasion of the meetings of the association. He hoped that both, or at least one, of these gentlemen would accept his invitation, and he had no doubt but that in the event of his being successful in announcing the names of those gentlemen as visitors to Tasmania, they would be received with the greatest satisfaction by the members of the association. He was glad to see so many present in this, the first meeting of the present session of the Royal Society, including their friend, Mr. Alfred J. Taylor, who had just recovered from a serious illness.

The RIGHT REV. H. H. MONTGOMERY, D.D., BISHOP OF TASMANIA, read a paper entitled "Some account of the Mutton Birds, or Sooty Petrels *(Nectris Brevicaudus)*, as seen in their Homes among the Furneaux Islands, Bass Straits, Tasmania, from Notes taken during a visit to the Locality in March, 1891."

Mr. T. STEPHENS called attention to some specimens on the table :—1. A specimen of shale from near the Henty River, with *Glossopteris*, etc., and closely resembling the shale in which more than twenty years before he found the first impression of this fern in the Mersey coal measures. Like the Mersey coal, this shale occurs under marine fossiliferous beds of carboniferous age. 2. Pieces of coal from the flanks of Mount Manfred, north-west of Lake St. Clair, cropping out at a height of about 3,000ft. above sea level. 3. Silurian limestone from the site of a bore recently put down at Railton in search of coal, with a portion of core belonging to the same series from a reported depth of about 600ft. Mr. Stephens remarked that the lavish expenditure which had been incurred here in boring through strata, which are well known by all acquainted with the geology of the district as being, geologically speaking, below the whole of the Mersey coal measures, was a startling instance of that enterprise of which Tasmania was supposed to be destitute. It was a pity that it was not more wisely directed.

The SECRETARY, in the absence of the author, read a paper, entitled "Notes on Mount Lyell District, Tasmania," by Mr. F. Danvers Power, F.G.S.

Mr. R. M. JOHNSTON replied briefly, when it was decided to postpone discussion until next meeting.

HIS EXCELLENCY proposed the usual votes of thanks to the contributors of papers, which having been carried by acclamation, the meeting adjourned.

MAY.

The monthly meeting of this Society was held on May 13, the President His Excellency Sir R. G. C. Hamilton K.C.B., in the chair. There was a good attendance of Fellows, and also a number of lady visitors.

THE ANTARCTIC EXPEDITION.

The SECRETARY read a telegram from Baron Von Mueller, suggesting a deputation from the Society to the Government in aid of the fund now being raised for the proposed Antarctic Expedition.

Mr. James BARNARD said that he was rather in favour of viewing this as an Australasian and Imperial question, and that the expense generally should be shared between Australia and the Imperial Government. It seemed, however, that there was no hope of that being obtained, and, therefore, he moved—"That it be a recommendation from the Society to the Council to wait on the Premier to see if the Government would be disposed to assist in this matter."

Sir LAMBERT DOBSON seconded.

The PRESIDENT said that the position of the matter was this. He received a telegram from Baron Von Mueller, which he read at last meeting, to the effect that New South Wales had put £2,000 on its estimates, and Queensland £1,000, and asking whether Tasmania would contribute £500. He had referred the telegram to Ministers, but had not heard from them. He took some blame to himself in the matter, because he had not applied to Ministers, but now that it had been proposed and seconded that a deputation wait on the Premier he thought that would be the best way to proceed.

The motion was agreed to.

CONGRATULATORY.

Mr. MORTON, as secretary, called attention to the fact that two members of the Society, Mr. James Barnard and Hon. Dr. Agnew, celebrated this month their jubilee as members of the Society. In 1841 both of these gentlemen were admitted as members, Mr. Barnard having been admitted on the motion of Mr. Bedford, seconded by Sir John Franklin. At that meeting there were present Rev. Dr. Lillie, and Captains Ross and Crozier, who had just returned from a cruise to the Antarctic Ocean. He believed that this Society, one of the oldest in Australia, was the only one that could boast of having two members who had been so long in membership, and still able to take their part as active working members. He saw from the records that Mr. Barnard had been very seldom absent from the meeting of the Society or of the Council. The only time there was a lapse in attendance was during Mr. Barnard's visit to England. He thought it his duty as secretary to bring those interesting facts under notice, and he placed before the Society the original manuscript of the election of Mr. Barnard, with the signature of Mr. Henslow, who was then private secretary to Sir John Franlkin, and acted as honorary secretary to the Royal Society.

Sir LAMBERT DOBSON expressed pleasure at hearing the interesting facts just stated, and said that all joined in congratulating Mr. Barnard and Dr. Agnew, and in wishing that they might yet be spared many years to take an active part in the work of the Society.

Mr. **Barnard** said he was quite taken by surprise by this recognition of his membership, and regretted that Dr. Agnew was not present on the occasion. He felt honoured by the reference made to himself. He had a feeling of shortcoming in that he had not throughout the long period referred to done more for the Society than he had done. Of course it should be remembered that during forty years he had the conduct of a very onerous department in the Government service, and had very little leisure to devote to scientific matters. He felt thankful for having been spared till this time and able to look back during all that vista of years. He remembered that the first paper read before the Society was an admirable one by the Rev. Dr. Lillie, and that Rev. Mr. Ewing prepared the first catalogue of Tasmanian birds, a work which has since been taken up and expanded very considerably by modern contributions from members of the Society. He did not, however, think he should inflict a speech upon them on the occasion, but would only again express his great appreciation of the feelings that prompted this reference to himself.

APPLE SCAB.

Mr. A. **Morton** drew attention to a fungus affecting the apple. During the last few weeks several apples had been sent him. On examination he found they were attacked by a fungus, and on submitting them to Dr. N. A. Cobb, of the Department of Agriculture of Sydney, he reported that the fungus was the ordinary apple-scab, *Fusicladium dendriticum*, and that it might be almost prevented, at a slight cost, by spraying the trees once in every two or three weeks during the spring and summer with the mixture known as "Ammonio-carbonate of copper." Dissolve 2lb. of copper sulphate (bluestone) in hot water. Dissolve 2½lb. sodium carbonate in another vessel of water. Mix the two together, and before using add 1½ pints of ammonia, and then dilute to 30 gallons with water.

The Secretary read the following correspondence:—

151, Macquarie-street, May 12th, 1891.

"Dear Mr. Morton,—I regret I shall be unable to be at the Royal Society's meeting to-night. Would you mind recording the existence in Tasmania of the two following plants:—

Lobelia rhombifolia, found in October, 1890, on the road from St. Helens to Constable Creek by Wm. Fitzgerald. The plant was sent to me, and I forwarded it to Baron Von Mueller, and I enclose his reply. Unfortunately I have no specimens.

Orthoceras strictum, found in December, 1890, by Mr. Geo. Hinsby near George's Bay. I recognised the plant as *O. strictum*, and when Baron Von Mueller was here he confirmed it I leave the dried specimen for your examination.

Kindly let me have the letter and specimen again, as I have to return the former, and wish to keep the latter.

Yours faithfully,
L. Rodway."

"Let me congratulate you, dear Mr. Fitzgerald, for your discovery of a plant, new as regards the records of the Tasmanian flora. It is the *Lobelia rhombifolia* of De Viese, originally found by Drummond in West Australia; in 1848 traced by me into South Australia, and since then found in some few places of Victoria. The Tasmanian locality will be recorded in my work under your honoured name. Where this plant occurs perhaps you may find other rare plants yet. As you seem to take an interest in the indigenous plants of your beautiful island I would particularly remark that the floating and submerged plants there require still more attention there than any others, even as far as the small water lentils. It would be well in each instance if the specimens were pressed and dried before they are sent off, as otherwise they suffer in transit. May I advise you to send to Mr. Alex. Morton, Secretary of the Royal Society of Tasmania, a note regarding the discovery of the Lobelia in your Island, and to dry specimens for being submitted to the next meeting in Hobart.

Regardfully yours,

FERD. VON MUELLER."

CALCULATING MACHINE.

Mr. R. M. JOHNSTON gave a lucid and practical demonstration of the method of working a new calculating machine introduced into the Statistician's Department to facilitate the work of that department in calculations. The machine is called the "Arithmometer." In the absence of the author Mr. Johnston read a paper, prepared by Mr. F. Jacobs, A.I.A., entitled "Notes on the Arithmometer as an aid to actuarial work."

The Secretary, in the absence of Mr. A. B. Biggs, read a paper prepared by that gentleman entitled "The Possibilities of the Telescope."

Mr. A. Montgomery, M.A., Government Geologist; Mr. W. F. Ward, Government Analyst, and Mr. T. Stephens, M.A., and Mr. R. M. Johnston, replied at some length to the paper of Mr. Powers, read at the last meeting, entitled "Notes on the Mt. Lyell District, Tasmania.

On the motion of His EXCELLENCY, the customary vote of thanks was passed to those who had contributed papers and remarks, and the proceedings terminated.

JUNE.

The monthly meeting of this Society was held on June 9, the President, His Excellency Sir R. G. C. Hamilton, K.C.B , presiding.

PAPERS AND PROCEEDINGS.

The SECRETARY laid on the table the published papers and proceedings of the Society for the year 1890.

ANTARCTIC EXPEDITION.

His EXCELLENCY said that at the last meeting of the Royal Society a resolution was passed asking the Council to wait on Ministers to ascertain whether they would be prepared to recommend Parliament to vote a certain sum towards the expenses of the Antarctic expedition under Baron Nordenskiold. Before, however, any action was taken by the Council, an intimation was received from Ministers that they had determined to ask Parliament for £300 towards the proposed expedition. He telegraphed that fact to Baron Von Mueller, and received the following telegram in reply :—" Grateful for support Tasmanian Government to Nordenskiold expedition. This greatly strengthens the whole cause." He did not know how far the matter had progressed since, but thought it satisfactory that in Tasmania everything had been done that could be expected in this matter.

AUSTRALASIAN ASSOCIATION FOR ADVANCEMENT OF SCIENCE.

His EXCELLENCY thought it desirable that a progress report should be made by Mr. Morton in reference to the arrangements for the approaching meeting of the Australasian Association for the Advancement of Science.

Mr. MORTON said that he had sent out 950 circulars to members of the Association and others throughout Australia requesting them to notify whether they intended to be present, although he had not received one quarter of the replies expected, already 150 had notified their intention of being present at the meeting to be held in Hobart on January 7 next. Papers had been promised by able contributors in the following sections :—Astronomy, chemistry, geology, biology, geography, economic and social science, anthropology, literature, and fine arts. He regretted to intimate that Sir Wm. McGregor, Governor of British New Guinea, had written stating that it was impossible for him to leave his work there early next year in order to attend and occupy the position of president of the geographical section. Mr. Morton further stated that liberal concessions in the matter of travelling rates had been granted to members, and he had no doubt that the result would be a large influx of visitors. At the meetings of the Association in New Zealand last year, large numbers of local residents became members of the Association, and he hoped a similar result would take place here, as by becoming members they would have the privilege of attending the different sections.

His EXCELLENCY said : I think we may be satisfied with the progress made as detailed by Mr. Morton. I may say that I also had a letter from Sir William McGregor similar to that received by Mr. Morton, but I thought the matter of so great importance, that I wrote to him again. I am sure it will be very agreeable to this Society to learn that I have succeeded in getting Mr. Giffen, the eminent statistician and political economist, to agree to pay me a visit during the session of the Australasian Association for the Advancement of Science to be held here in January next, and to read a paper before the Association. Mr. Giffen, as many of you know, is one of the highest living authorities on economic science, and I am sure that his presence on this occasion will be greatly appreciated by the members of the Association, and that it will give an impetus to the study of this science, which will bear fruit throughout all the Australasian colonies. (Applause.)

The SECRETARY apologised for the absence of Mr. R. M. Johnston, owing to indisposition, and read the following remarks, prepared by that gentleman in connection with this subject:—It is pleasing to observe with what enthusiasm His Excellency Sir Robert Hamilton, the president-elect of the Australasian Association for the Advancement of Science, is endeavouring to make this, the fourth meeting, taking place in Hobart in January next, one of the most successful of the series yet held. The Association, mainly owing to the instrumentality of its present permanent general secretary, Prof. Liversidge, was founded in the year 1886, and has since held three very successful meetings; the first in Sydney, in January, 1888; the second in Melbourne, in January, 1890; the third in Christchurch, New Zealand, in January of the present year. The Association follows exactly the lines of the British Association, and like that Association its objects are—To give a stronger impulse and a more systematic direction to scientific enquiry; to promote the intercourse of those who cultivate science in different parts of the Australasian colonies with one another and with foreign philosophers; to obtain a more general attention to the objects of science and a removal of any disadvantages of a public kind which may impede its progress. Science in Australasia has already received a great impulse from these yearly gatherings, the direct and indirect results of which will have a most important bearing upon the intellectual, social, and material progress of these colonies. It is evident from what has been disclosed at the last meeting of the Royal Society that His Excellency Sir Robert Hamilton does not intend that one of the express objects of the Association should remain a barren phrase, viz.:—"To promote the intercourse of those who cultivate science in different parts of the Australasian colonies with one another and with foreign philosophers." Already he has, through the energetic General Secretary (Mr. A. Morton, F.L.S.), received the assurance that at its next meeting in Hobart will be assembled one of the largest gatherings of scientific men of Australasia which has yet been brought together, including nearly all the most prominent names in various branches of science, art, and philosophy; and he has also endeavoured to throw additional lustre upon this gathering by cordially inviting as his guests for the occasion several of the most illustrious men of science in the Mother Country. One of these, Professor Huxley, has written a most cordial letter regretting that the state of his health alone prevents him from accepting His Excellency's hospitality and denying himself the pleasure it would afford him to re-visit Tasmania, of which he has still many pleasant recollections. It is gratifying, however, to know that he has received the assurance that Dr. Giffen, LL.D., now created a C.B., one of the most illustrious economists and statisticians of Europe, is to become his guest, and will be present to take part in the work of the Association. In economic science the name of Dr. Robert Giffen stands in the very first rank of the most illustrious names in Europe, and there is no authority in Europe who at the present moment is held in greater respect, and whose writings exert a deeper and wider influence on the great political and social economic problems which at present disturb the industrial relations of nearly all civilised countries.

Of the many distinguished Presidents of the Royal Statistical Society of England it is certain that he ranks among the foremost, while his numerous contributions to the journal of that Society, in connection with important questions of the day, reveal what a marvellously wide and thorough grasp he possesses of the facts which bear upon the subjects which he discusses, and of the still more remarkable power displayed by him in the manner in which he brings his facts into logical array, and in drawing important conclusions therefrom. Perhaps in this respect he has no living equal in his own branch of science. The following is a list of the more important papers on statistical and economic subjects contributed by Dr. Giffen to the Royal Statistical Society since the year 1879:—(1) "On the fall in prices in recent years."—(Journ. S.S., Mar. 1879). (2) "The progress of the working classes in the last half century (presidential address).—(Journ. S.S., Dec. 1883.) (3) "Further Notes on the progress of the working classes in the last half century."—(Journ. S.S., Mar. 1886). (4) "Recent rate of material progress in England" (presidential address, Brit. Assoc. 1887).—(Journ. S.S., Dec. 1887). (5) "Recent changes in prices and incomes compared."—(Journ. S.S., Dec. 1888.) (6) "Accumulation of capital in the United Kingdom in 1875-85."—(Journ. S.S., Mar. 1890). Dr. Giffen's presidential address to the Royal Statistical Society in 1883, "The progress of the working classes in the last half-century" was a most remarkable one, and created a profound impression throughout Europe, America, and these colonies, and the effect on the minds of the leading statesmen of the United Kingdom is best indicated by the fact that at Mr. Gladstone's special request the address was reprinted, and widely circulated throughout the United Kingdom. Dr. Giffen is also widely known as the author of several important works on financial matters. The presence of such an illustrious economist will add great lustre to the coming meeting of the Association, and will be especially welcomed by Section F.—Economic and Social Science and Statistics—where his active support and influence will undoubtedly increase the interest and usefulness of its proceedings.

SOUTHPORT CAVES.

His Excellency said that there had recently appeared in the Press an account of some caves recently discovered at Southport. Mr. Morton formed one of the party who visited the caves, and brought away some specimens, and he thought it would be interesting to hear from him an account of that visit.

Mr. Morton said that an opportunity having been afforded to visit the caves in the vicinity of Ida Bay, near Southport, he took advantage of it, and notwithstanding the short time at his disposal he thought that what he saw was sufficient to justify writing to the Minister of Lands, drawing his attention to the very urgent necessity of having these caves thoroughly examined and a report furnished, with a view of having them protected, under similar conditions to the well-known Jenolan and Fish River Caves in New South Wales. As these caves were of easy access from Hobart, excursionists being able to reach them within five or six hours, they should undoubtedly prove a favourite resort to tourists and visitors to the colony. They were situated about four miles from Ida Bay, and a fairly good road led to them. On reaching the mouth of the caves it was seen that the entrance was through a limestone formation. There was a very strong stream flowing along the floor of the cave. The first chamber reached showed some fine stalactites, and along the floor some fine stalagmites were seen. On extinguishing the lights carried by the party the ceiling and sides of the caves seemed studded with diamonds, millions of glow-worms hanging to the sides of the walls and from the ceilings causing this phenomenon. Proceeding further, several chambers were explored, each revealing grander sights. The time at disposal being limited, the party had to return after traversing a distance of about three-quarters of a mile, but from what was observed the caves evidently extended a distance of three or four miles. The only life met with in the caves were the glow worms previously mentioned. These caves, under proper supervision, should become one of the great attractions of the South.

Mr. **Bernard Shaw** concurred in the recommendation made by Mr. Morton, and hoped it would be adopted by the Minister of Lands. He thought that there would be very little trouble in having those caves protected, as there was a station with resident police at Southport.

NEW ZEALAND EXHIBITS.

Mr. **Morton**, as Curator of the Museum, drew attention to specimens of greenstone from New Zealand, also of axes and knives used by the Maoris, the latter being made out of obsidian, the gift of Messrs. A. Hamilton and F. R. Chapman, of Dunedin, New Zealand, to the Tasmanian Museum.

The Secretary read, in the absence of the author, the following papers :—1. "Results of observations of the transit of Mercury on May 10, 1891." 2. "The total eclipse of the moon on May 24, 1891." By A. B. Biggs.

JULY.

No meeting held.

AUGUST.

The monthly meeting of this Society was held on Monday evening, August 17. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., presided, there was a large attendance of Fellows, also a number of ladies.

NEW MEMBERS.

Dr. O. Burchard, of Hamburg, was elected a corresponding member, and the following to be members :—Walter Spencer, M.D., Launceston; W. F. M. Shells, M.R.C.S.E.; George Henry Gibson, M.B. and C.M., Edinburgh; Wm. Earle, Mount Zeehan; Ernest Milton Law, and Wm. Dubrelle Weston.

MACQUARIE ISLAND.

The Secretary read the following letter from Captain Fairchild, of the New Zealand Government steamer Hinemoa.—" Wellington, June 3, 1891 :—I see your Government has prohibited sealing on the Macquarie Island. It is a wise step, because if it had gone on a few years longer there would not have been a seal or a sea elephant left on the island. I think the penguins (the king penguin *Aptenodytes longirostris*) should be protected for, say, five years on Macquarie Island, or else they will soon be all gone—that beautiful bird is only found on the Macquarie Island. There are none on any of the islands belonging to New Zealand, and as they are such a helpless bird and so easily caught, there will not be one left in five years if they go on killing as they have the last year or two. So I hope soon to hear that the king penguin are not allowed to be killed on Macquarie Island for the sake of their oil. The man on the island told me he killed 15,000 last year for their oil, from which he got 15 tuns of oil."

Sir LAMBERT DOBSON suggested that as the subject was a new one it should be considered by the Council and afterwards by the Society, so that it could go before the Government after mature consideration. He moved,—" That the letter be referred to the Council of the Society," which was agreed to.

SCIENTIFIC INFORMATION.

In the absence of the author, Mr. A. J. Ogilvy (the SECRETARY) Mr. Morton read an abstract of the paper prepared by that gentleman, entitled " Suggestions as to the best means for collecting scientific information." The writer suggested that the Royal Society should obtain the services of some resident in each district of the colony, if possible, to act as its hon. representative in that district. He should commence as soon as he conveniently could to collect specimens illustrating the geological features and useful products of his district as, generally, of the granite or other chief rocks, especially of the coal, limestone, fireclay, or other useful products, for comparison with similar specimens from other districts. Also any striking examples of petrifaction, crystallisation, etc., in short anything likely to be of scientific interest. On hearing of any interesting discovery in his district, he would put himself in communication with the discoverer and report to the Society. He would be the recognised agent of the Society in the district to whom discoverers and inquirers would voluntarily apply to give or receive information; to whom also the Society could refer for any special local information it might require. Such an appointment would not only serve many direct practical ends but would also arouse increased interest among these co-operators in scientific subjects and in the affairs of the Society; would stimulate them to closer attention to their surroundings, and would help to propagate an interest in scientific progress throughout the colony.

AUSTRALASIAN SCIENTIFIC ASSOCIATION.

His **Excellency** asked if there was any progress report *re* the meeting of the Australasian Scientific Association for the Advancement of Science in January next.

Mr. **Morton** said that so far everything was progressing very favourably. Some 200 members had already signified their intention of being present, and a number of papers had been promised. He had also pleasure in intimating that ladies would be admitted to the meetings and have the privilege of taking part in the discussions and reading papers on payment of a small fee.

PAPERS.

TASMANIAN INSECTS.

The **Secretary** read an interesting extract from a letter written by Mr. J. J. Walker, R.N., Chief Engineer of H.M.S. Penguin, in which he stated that the collection of insects made by him during his visit to Hobart had turned out well. He had sent to the British Museum 1,122 mounted specimens. They consisted of 586 species of coleoptera from Hobart, and 1,871 specimens of 798 species from all Tasmania, being perhaps one-fourth of the varieties of insects in the island.

HYPNOTISM AND ALLIED PHENOMENA.

Dr. **Walter Spencer**, Launceston, read a paper on the above subject. The paper was a lengthy and elaborate one, and in it Dr. Spencer dealt with the established facts in regard to Hypnotism, and described the sensation which it caused among members of the medical profession when introduced as a means of painless operations. Although its use in the alleviation of pain among the medical profession in England gave place to chloroform and ether it was taken up in France where two different schools prosecuted its study. He gave illustrations of the rival methods employed by practitioners of this new power, and pointed out the dangers of its practice, which caused the British Medical Association to pass a special resolution on the subject. He described how he had practically studied the subject in London 15 years ago, and at the end of a series of 12 lessons was able to relieve small pains by its use. He showed the identity of hypnotism with mesmerism, and gave a most interesting account of the history of such phenomena illustrated by numerous examples. A discussion followed, in course of which Messrs. A. J. Taylor, R. M. Johnston, Justice Adams, and Sir Lambert Dobson took part, after which a vote of thanks was awarded to Dr. Spencer.

His Excellency retired to fulfil another engagement, and His Honor Sir Lambert Dobson took the chair.

TASMANIAN PLANTS.

The **Secretary** read some brief remarks by Baron von Müeller, bringing under notice some rare Tasmanian plants lately found by Mr. T. B. Moore on the highlands east of Mount Tyndall. Baron Müeller considered the plants to be a new species of *Coprosma*, its characteristics being a very depressed, matted growth, very small leaves, and terminal small-sized fruit. The leaves were pointed, and the fruit beautifully blue outside. He recommended that if the plant proved a peculiar species it be distinguished under the finder's name.

Baron Müeller also acknowledged indebtedness to Mr. Moore for providing him with specimens of the *Panax Gunnii*, a rare shrub, found in deep shady gorges at Mount Lyell on the Canyon River, the Franklin River, and on a tributary of the Pieman River. From the highlands of Mount Read and Mount Tyndall, Mr. Moore sent specimens of the *Pentachondra verticillata*, a species of *Styphelia*, which until now was only known from Dr. Milligan's collection.

MOUNT LYELL.

The **Secretary**, in the absence of the author, read notes on the Mount Lyell district by Mr. F. Danvers-Power, F.G.S., being a rejoinder to criticisms by members of the Society on the paper recently written by him on that subject. The writer expressed surprise that his critics credited him with being the author of new theories. It was possible that he was the first to apply the views expressed in his paper to Tasmanian geology, but he did not pretend to be the originator of what Mr. Stephens termed the "water pressure and wave theory," or of the anti-true-fissure-lode theory, although he was prepared to uphold them until disproved, or more suitable substitutes were brought forward, His paper was intended to give but a sketch of the geology of the Mount Lyell district. He was aware from Tasmanian literature, as also by personal conversation, that his views were in opposition to those generally accepted in the island, but by bringing the results of modern research to bear on local conditions, he had hoped to direct thought out of the groove into which it had fallen. Of course he did not expect to win those who had strong views on the subject over to his side at once, but he did expect them either to give valid arguments for their side of the question, or to prove his incorrect, especially when those sentiments were due to misconceptions on their part. He then dealt at length with the points on which his critics differed from him—(1) the main cause of mountain ranges; (2) the nature of most so-called true fissure lodes.

Discussion on Mr. Power's paper was postponed to a future meeting.

This concluded the meeting.

LIST OF ADDITIONS TO THE LIBRARY.

Aborigines of Australia. A paper read before the American Antiquarian Society, Boston, April 30, 1890, by E. E. Porter, M.A. From the author.

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Catalogue de la Bibliothique, Fondation Teyler. Harlem. From the Department.

Catalogue of the Chinese Imperial Maritime Customs Collection, at the U.S. International Exhibition of Philadelphia, 1876. From the Department.

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Catalogue of the fossil Cephalopoda in the British Museum Natural History, Pt. II., containing the remainder of the sub-order Nautiloidea, consisting of the family Lituitidæ and Nautilidæ, with a supplement by A. H. Foord. F.G.S. Catalogue of the fossil Fishes in the British Museum, Pt. II., containing the Elasmobranchii, Acanthodii, Holocephali, Icthyodorulites, Ostracodermi, Dipnoi, and Teleostomi, and Chodrostean Actinopterygii, by S. Woodward, F.G.S.,F.Z.S., etc. From the Trustees.

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SEPTEMBER.

The monthly meeting of this Society was held on Tuesday, September 8, the President, His Excellency Sir R. G. C. Hamilton, K.C B., in the chair. There was a large attendance of members and ladies.

The following were elected Fellows of the Royal Society :—Ven. Archdeacon Mason, Rev. James Scott, D.D.

His Excellency referred to the paper read on behalf of Mr. A. J. Ogilvy at last meeting on the best means of collecting scientific information, and suggested that the matter should be brought under the notice of the approaching meeting of the Australasian Association for the Advancement of Science. He considered that valuable information would be obtained if, as suggested, there was a representative of the Society in every district to keep his eyes and ears open, and let them know of anything of scientific interest.

Mr. A. J. Ogilvy said he regarded it as very important that in every district the Society should have some one to represent it, and pointed out that if at any time it wanted any special local knowledge there would be somebody to whom application could be made. He thought that the Fellows should consider as to the best means of carrying out the suggestion made, and deal with the subject at a future meeting.

Mr. A. Morton, as General Secretary to the Association, gave a satisfactory progress report *re* the arrangements for the approaching meeting of the Australasian Association for the Advancement of Science, and hoped at next meeting to present a report giving a list of the papers to be read.

ELECTRIC TRACTION.

Mr. Montague Jones, C.E., read a paper on the above subject. He said that whether the present generation had discovered the ultimate force in nature most applicable to the service of men was a question for the scientist of the future to decide, but he thought they could claim the present to be an electrical age, as in pre-historic times there were ages of stone and bronze. The practical utility of the application of electricity to the propulsion of railway and tramway cars was first demonstrated at Berlin in 1879 by Siemens and Halske on an experimental line of 500 metres, in the form of an oval. The train consisted of a small electric locomotive and carriages, which had very small wheels, with two rows of seats running parallel to the rails. The success of this experiment led to other attempts of an exhibitional nature at Brussels, Dusseldorf, Frankfort and other places, and then electrical traction passed from the experimental to the commercial process of development. The Lichterfelde electric tram near Berlin was the first of its kind. The length was 1½ miles, and the equipment in 1881 consisted of two motor cars, the motion being transmitted to the wheels by belts working on grooved pulleys outside the wheels. The prime source of power was a steam engine, with a Siemens motor and generator, but the installation differed in some respects from the Berlin line, the central rail not being used, but the one rail acting as a lead, and the other as a return for the current. Up to 1887 this line carried 100,000 passengers yearly. These instances showed that the inception of electrical tramways took place in Europe, the principle being the generation of electricity by dynamo, and conveying the current through conductors connected by sliding contact with the cars while in motion. Modern electrical railways were now built chiefly on this principle, although America had far succeeded Europe in the improvement and perfecting of the system. The remainder of the paper consisted of a description of the various systems in vogue, after which he dealt with the "overhead system," which had most successfully operated commercially and practically. Many objections of an æsthetical nature had been urged against the overhead gearing, but they were more apparent than real, and he recommended such objectors to look to the telegraph cables so obtrusively conspicuous in big towns. It was superior to other systems of traction. Traction expenses on horse tramways amount to two-thirds of entire working expenses, to say nothing of its inhumanity, and steam was a clumsy, though effective, method of applying force. He considered that the citizens of Hobart would be wanting in public spirit if they permitted steam engines to run along their streets. If a draughtsman sat down and deliberately attempted to design an affront to a decent community, he could not have succeeded better than at Sydney, where the working expenses amounted to three shillings per tram mile. It was now generally admitted that the struggle for existence lay between the cable system and the electric. The cost of the construction of the former in Melbourne amounted to £34,000 per mile and 75 per cent. of the available energy was lost by dragging the cable itself. At Minneaopolis, £80,000 was spent in the purchase of cable plant which was cast on one side as scrap iron to make way for an electrical system. The cable tramway could certainly surmount phenomenal grades, but on the other hand the electrical tramway could negotiate 1 in 8 grades, or even less. It was only a question of power, and Mr. Reis, an electrical engineer, had made some very valuable discoveries as to electrical braking and adhesion, which he hoped to see practically demonstrated at an early date. It was difficult to surmise what shape electrical developments would take place in future, its potentiality being apparently infinite, but it was no stretch of imagination to say that it was the locomotive power of the future. The various stages in the history of electric traction as described in the paper were illustrated by diagrams shown with limelight effects by Mr. Nat Oldham, and assisted greatly in conveying a clear comprehension of the lecture to the minds of the audience.

Mr. **JOHN MACFARLANE** said he had an opportunity of gathering information on this interesting subject, being in correspondence with the Thomson-Houston Company, makers of electric railway plant. Electric traction had left the region of scientific experiment and was an established commercial success. In the United States there were 310 tramways or railroads worked by electricity, with 4,000 cars and 7,000 motors. It was estimated that one-third of the street railway mileage in the States was worked by electric traction, and he referred to a number of companies which paid 8 per cent. With regard to steep grades he believed that 1 in 7 was not too steep for working, but he believed that the steepest grade in the proposed Hobart line was 1 in 16. It was interesting to note further that electric traction had also been successfully applied to tramways for mills and manufactories. In conclusion, he referred to the testimony as to the safety of the overhead wire system.

Mr. **C. W. S. JAMES** said he had been deeply interested in the paper read, and had tried to think how far the electric traction system could be applied to Hobart. A few months ago he had estimated what could be done in Launceston by utilising the South Esk River and he thought that there from 1,000 to 1,300 horse-power could be available. In regard to Hobart, however, there was not the same power available, and he believed they would require to look to generated power in any electrical system introduced. He thought the system could be usefully applied to carrying minerals on the West Coast, and that the "overhead system" was well adapted for the streets of Hobart.

Mr. J. Fincham said he had followed the paper with interest, but they had no reference to the length of the steep grades surmounted. He believed that in any scheme for electrical traction in Hobart this would be one of the difficulties. He was aware that there were about 300 tramways in America, but he had not been able to get any particulars as to the grade, or whether it was equal to such a grade as they had to contend with in going up Elizabeth-street.

Mr. A. W. Lawder thought the length of grade to be overcome simply resolved itself into a question of the power of the accumulator.

Mr. Fincham said that was just the difficulty the engineers found. They had not been able to provide enough accumulation to overcome a sustained strain.

His Excellency, in bringing the proceedings to a close, thanked the author of the paper, and all who had taken part in the discussion. He was pleased to see such a large meeting, and was quite sure that Mr. Jones, by his interesting paper, had justified the expectations of all present.

The proceedings then terminated.

OCTOBER.

The monthly meeting of the Royal Society of Tasmania was held on Monday evening, October 12th, the President (His Excellency Sir Robert G. C. Hamilton, K.C.B.,) in the chair, a large number of ladies and members being present.

The PRESIDENT said before calling upon the Secretary to give a report on the progress of the Australasian Association for the Advancement of Science he was sorry to have to inform the members that Sir Wm. MacGregor had wired to him stating that he would be unable to be present at the meeting to be held in January. His Excellency said he was pleased to say that he had a letter from his friend Sir Robt. Ball, Astronomer Royal of Ireland, who, although unable to be present, had promised to forward a paper to the astronomical section. (Hear, hear).

The Secretary (Mr. Morton) said Professor T. W. E. David, F.G.S., Professor of Geology at the Sydney University, had been asked and had accepted the presidency of the geological section, rendered vacant by the death of Mr. C. S. Wilkinson, and for the geographical section Commander Pasco, R.N., of Victoria, had been appointed. Committees of the various sections had been appointed, and the preliminary programme was now in the hands of the printer, and would be ready in good time. Titles of papers had been received from members residing in the several colonies, and the bulk of most of the papers no doubt would be forwarded during the next few weeks. Mr. Morton referred to the recent meeting of the American Association that had met in the United State and said he hoped that, as at that meeting, at the Tasmanian gathering many ladies would take part, not only in the discussion, but would contribute papers to the several sections. (Hear, hear.) The secretary further remarked that he was pleased to say everything in connection with the coming meeting promised well.

His Excellency said before calling upon Mr. Johnston to read his paper, he would like to say that at the last meeting Mr. Montague Jones had, owing to some oversight, been unable to reply to those who took part in the discussion following Mr. Jones' paper, and he would now ask Mr. Jones to reply.

Mr. JONES said in a discussion which followed the reading of the paper on electric traction Mr. Fincham appeared to associate the "storage system" with the practical operation of electric trams, but it was clearly pointed out that the "storage" up to the present time was an ideal method, and that the "overhead system" was the only one of practical value. The main defects of the former are the limited capacity of the cells, and when brought to bear on a grade of 5 per cent. or over heat instead of current was developed, which buckled the cell plates, rendering them useless, and again, the cells are composed of lead, weighing altogether 3,000lb., which has to be carried about over light as well as the heavy grades, losing 60 per cent of the available efficiency. Coming to the "overhead system," the question of surmounting heavy and continuous grades resolves itself into a question of increased power, which is always to be obtained from the central station, and herein lies the great advantage the overhead system has over any other. All the available energy can be utilised excepting a few points per cent.. due to the resistance of the current by the conductor. The maximum grade in Hobart is 1 in 16, and is slight compared with some of the towns where cars are being operated by electricity. The following is an extract from the directors of the "Richmond Union Passenger Line" to Mr. Sprague:—"The road which you have equipped under most trying conditions has been one of the most, if not the most, difficult which could be met with in street railway work. The excessive and continuous grades, the numerous sharp curves, the gradients in these curves, the weight of the cars, and the heavy roads which they have been required to carry together with the extent of the system, and the number of the cars in operation (about 40) constitute the enterprise, the largest and most difficult yet inaugurated in any part of the world. We acknowledge the successful fufilment of all the terms and conditions of the contract, and compliment you upon having achieved so signal a success." The number of street electric railways at work, and the number contemplated, is quite sufficient to prove that it has long since passed beyond the experimental stage of development. Citizens of Hobart should keep these facts in view and refuse to listen to any argument stating it to be impracticable to introduce an electric service here; the wretched apology for a permanent way will certainly have to be removed, and a neat steel grooved rail put in its place, as the basis of efficient street transit is a smooth and sound rolling surface. I would also like to see a 4ft. 8½in. gauge, instead of a 3ft. 6in. gauge, as the latter might create mechanical difficulties which cannot at present be foreseen, as all the electric roads, or nearly so, are built to narrow gauge requirements. Of course these difficulties would be overcome; still it is just as well to be on the safe side. As regards a prime source of power for Hobart, it is a simple question of cost and maintenance whether water or steam would be better. There is plenty of water, and the cost to supply a constant head would be, I think, much less than coal. Two hundred h.p. would be more than sufficient force for a service of 12 cars, and as to the mechanical power for equipment it does not make much difference whether the grades be 1 in 5 or 1 in 10, as the motors used are of a standard size, having a capacity of 15 h.p. each. Where the grades do not exceed 4 to 5 per cent., one motor could do the work, but where the grades exceed 5 and run up as high as 10 per cent., then it is unsafe to operate, except by driving both axles, and then the equipment must be two 15 h.p. motors. The average weight for street motors' equipment is about 100lb. per h.p. Hence 2·15 h.p. motor equipment will weigh about 3,000lb. I have deduced this to mathematical formulæ following:—H.P. 4·75=M.T, (C x 1), where M miles per hour, T No. of tons, C rise in feet per 100. The cost of single line "overhead" construction, including permanent way material, under average conditions should not amount to more than £3,500 per mile. This, in comparison with the cable system at Melbourne at £34,000 per mile is very marked, and the economy of the overhead system is so manifest that Mr. Henry Peabody, of Boston, wrote to me as follows, in reply to inquiries:—"There is a feeling among all Municipal Councils, where railways apply for 'overhead lines,' that the increased economy warrants their asking for a decrease of fares, hence their desire to keep quiet about their balance-sheets." Mr. James asked me to explain the Telpherage system. There are two, "the series" and the "cross ones parallel." The latter is now being operated in many places. The skips or trucks are suspended from an iron rod supported by poles, and the rod acting as a conductor, is constructed on the "break and make" principle at every 120ft. or so, taking its supply of current from a dynamo fixed at a convenient place. The "makes and breaks" are normally closed, so that a current of electricity may flow from end to end, but when the first wheel of the skip of a train touches the "break" the circuit is closed and the currentruns back to the last wheel of the train, and into the skip containing the motor and thereby energising the train. The same operation to continues at the intervals stated the end of the journey. It can be worked up to 15 miles per hour with ease, and the cost of carrying is about 1s. 2d. per ton per mile. Unlike most new inventions "Telpherage" does not persist in adhering to any principle of an obsolete type, but is an innovation so extraordinary as to pass all practical experience. As feeders to the West Coast lines nothing could be more admirable, and not as the remote future we shall see it universally adopted, instead of those useless unpayable lines and costly roads that cripple the revenue of new countries.

Mr. W. F. **Ward** (Government Analyst), said he did not intend to say very much, as he had expressed himself at a previous meeting. He would, however, say that he entirely disagreed with the views put forth by Mr. Power.

Mr. **Alfred** J. **Taylor**, F.L.S., read the following paper, entitled "Notes on the Shell-mounds at Seaford, Little Swanport."—Among the many interesting relics of the aborigines of Tasmania that yet remain, not the least interesting are the shell-mounds that mark the spot where they formed their encampments and feasted before the intrusion of a white race had disturbed their simple and peaceful modes of living. Such shell heaps as that to which I am about to refer occur in other parts of the world, and for some time they were supposed to be nothing more particular than ordinary "raised beaches." Even now in Tasmania there are many well-informed people who cannot bring themselves to believe that the shell heaps noticeable in many places on our shores are the kitchen-middens, or "refuse heaps," of the aborigines of the colony; and it is for the information of such sceptics that I place on record the following evidence as establishing beyond all reasonable doubt the fact that they are this, and nothing more. One has only to examine these remarkable accumulations to obtain evidence of an intensely interesting and convincing character, and the results of a personal examination of the extensive shell mounds to be found on the estate leased by Mr. Samuel Drake at Little Swanport have induced me to hope that a few notes on the subject may be of some interest to the fellows of this Society.

Mr. R. M. **Johnston** said he was very pleased to find Mr. Taylor had taken so much trouble in obtaining such valuable information dealing with the aborigines of Tasmania. The paper read by Mr. Taylor was extremely interesting from an ethnological point. He (Mr. Johnston) had paid considerable study to the working out of the shell deposits, and on a recent visit to the place referred to in Mr. Taylor's paper he had observed the remains of charred wood, proving that the great deposits of shells had been made by natives, and were not formed by other agencies.

Mr. E. D. **Swan** said some years back Mr. Mitchell, who resided on the East Coast, had, at a meeting of the Society, spoken on this matter, and had been told by the natives themselves that they had de posited the oyster shells that formed the extensive deposits.

Mr. **Morton** said the paper read by Mr. Taylor was a most important one from an ethnological point, the specimens collected being exceedingly interesting. Although there was a difference of opinion still existing regarding these shell deposits, from what he himself saw he could arrive at no other conclusion than they at one time were formed by natives. Although Darwin in his work "on the structure and destruction of coral reefs and geological observations on the volcanic islands," page 258, states that during his visit to Tasmania he examined several of the shell deposits, and was of opinion that while some of the mounds may have been formed by the aborigines, the greater number of these deposits he considered had been caused by a small elevation of the land. Captain Grey and other travellers have found in Southern Australia upraised shells, belonging either to the recent or to a late tertiary period. The Rev. W. B. Clarke found proofs of the elevation of the land, to the amount of 400ft. at the Cape of Good Hope. Darwin says that when visiting Tasmania he was assured by an intelligent farmer that oysters were formerly abundant in Ralph's Bay, but that in the year 1834 they had without any cause disappeared. In the "Transactions of the Maryland Academy," Vol. 1, Pt. 1, p. 28, there is an account by Mr. Ducatel of vast beds of oysters and clams having been destroyed by the gradual filling up of the shallow lagoons and channels on the shores of the United States. Darwin, when visiting New Zealand, says he observed in the neighbourhood of the Bay of Islands, that the shores were scattered to some height, as at Van Diemen's Land, with sea shells which the colonists attributed to the natives. He (himself) was of opinion that the land had been elevated. The bone Mr. Taylor had been fortunate to obtain from the shell deposits clearly showed that it had been made by the natives, and was a most valuable relic.

Mr. A. J. **Ogilvy** drew attention to some caves at Rocky Mouth that he had visited, and had been dwelling places of natives. On examination he felt sure many interesting relics might be found.

Mr. **Taylor**, in reply, said he felt very pleased at the great interest his paper had caused, and promised to lay before the Society any further information he might obtain, and also he would be pleased to present to the Museum any specimens he might have in duplicate.

Mr. W. A. **Weymouth** exhibited a magnificent collection of Tasmanian mosses collected and mounted by him. The collection consisted of many species, Mr. Weymouth kindly promising to present a mounted set to the Museum.

Capt. **Shortt**, R.N., also exhibited a choice collection of photographs of the "milky way and nubecutœ," taken at the Sydney Observatory, 1890.

THE EARTH'S CRUST.

Mr. R. M. **Johnston**, F.L.S., read a paper entitled "Observation on the Causes of Elevation and Subsidence of the Earth's Crust." He referred to the difficulties of dealing with a subject which necessarily rests so largely on arbitrary values for unknown data, and stated that as this was so it was obvious that any view he might tend to favour must in his own mind be attended with a large measure of doubt, and on some obscure points his judgment must be suspended entirely. As a novel theory, however, has recently been referred to by Mr. F. Danvers-Power relating to the elevation of mountain chains, he entered more fully into the consideration of those hypotheses of causation which have gained the most favour among physicists and geologists. He divided his paper under the following heads:—Formation of continental areas and ocean basins; contraction theory; the alleged expansion and contraction of the underlayers resulting from a rise or fall of temperature caused by the loading or unloading of the areas affected; expansion and contraction of the underlayers resulting from a rise or fall of temperature; Mr. Danvers-Power's reference to the supposed influence of the pressure of ocean waters upon the formation of parallel mountain chains; and concluded with the thought that good reasons had been given for rejecting the theory put forward by Mr. Danvers-Power.

His **Excellency**, in moving a vote of thanks to the authors of the papers, Messrs. Johnston and Taylor, said that although Mr. Ward had spoken strongly against the views expressed by Mr. Danvers-Power, in a paper contributed by that gentleman at a former meeting, the fact of having Mr. Power's paper had been the means of causing Mr. Johnston to read a most valuable paper. With regards to Mr. Taylor's paper he was of opinion that that gentleman deserved the thanks of the Society for the very valuable information he had obtained.

The meeting then closed.

NOVEMBER—No Meeting.

SOME ACCOUNT OF THE MUTTON BIRDS, OR SOOTY PETRELS *(NECTRIS BREVICAUDUS)*, AS SEEN IN THEIR HOMES AMONG THE FURNEAUX ISLANDS, BASS STRAITS, TASMANIA, FROM NOTES TAKEN DURING A VISIT TO THE LOCALITY IN MARCH, 1891.

By H. H. Montgomery, D.D., Bishop of Tasmania.

My duties called me last March to undertake a trip to the Furneaux Islands. Before I started I was aware that one of the most interesting subjects for an ornithologist in that part of the colony would be the habits of the mutton bird. But the reality so far surpassed my expectations that I have ventured to lay before the Society some results of my observations. Mr. J. B. Walker has shown me allusions to the subject in old books of travel. Mr. Barnard has been good enough to furnish me with the second volume of the Tasmanian Journal, in which a short but excellent account is given of the habits of the sooty petrel, or mutton bird, by Mr. R. H. Davies. As the paper was written 45 years ago it may be worth while putting on record what I now propose to lay before you. These petrels choose islands where the soil is composed of a loose sand, covered in places by a bush with a blue flower called "barilla," where they congregate for the purpose of digging the holes in which they lay their eggs. I have heard of a rookery in Port Davey: and among the Hunters Islands they breed on Trefoil, Sheephead, Doughboys, and the Petrels. On the northern coast there used to be large numbers on Waterhouse Island, until the pigs kept by Mr. Barrett found them out, and destroyed such vast quantities that the birds deserted the place, and now there are just a few which are carefully preserved. In the Furneaux group they used to breed in much greater numbers than at present, and I venture to hope that the chief effect of this paper may be a timely movement by the Government to save from almost utter destruction an industry which adds distinctly to the wealth of the colony, and supplies a healthy article of food. At present the most important homes of these birds in the breeding season are Chappell Island (called usually "Hummocky," because of the hill in the centre), Little Dog and Big Dog Island, Green Island and Little Green Island, and Babel Island. These places are nothing more than low sandy spots, from 300 to 1,200 acres in extent, with hardly a tree (except on Big Dog Island), and covered with long yellow grass growing up to the waist. Most uninviting looking spots they appear to be. As you pass them in the day time you might fairly suppose that there was no living thing upon them except an occasional shag or a Pacific gull. I have thought that a sailor wrecked on one of these little wave-beaten spots might even starve if he slept soundly at night, ignorant that under his feet there lay concealed hundreds of thousands of birds, which, when eaten fresh, are among the most delicious of foods. About the middle of September the sooty petrels visit these breeding places, coming in at night and remaining some ten days, in order to dig their holes. They effect this with their feet, scattering the sand behind them in clouds. When this preliminary task is finished they leave their future nests for four or five weeks, and are not seen at all in the neighbourhood. In the middle of November they commence laying eggs. Mr. E. D. Atkinson has taken fresh eggs on November 21. Whether the males feed the mother birds during the period of incubation I do not know. But as the males return every evening it is probable that they do. Only one egg is laid by each female, and it is doubtful whether in the case of the egg being destroyed another is laid. I failed to enquire at what period the young bird is hatched out, but I gather that it must be at the commencement of January. On the 3rd of March I landed on Little Dog Island, and received my first introduction to these most interesting sea birds. At 6 p.m. not a mutton bird was in sight. Indeed, during the fortnight that I was cruising about in a boat I never saw a petrel in the day time anywhere. It is their habit to fly away to sea very early in the morning to distances 40 and 50 miles away, returning only when it is dusk. Whether they have long ago cleared the immediately surrounding waters of the food they require I cannot say; but it is a surprising fact that not one of the old birds is ever visible in the neighbourhood of their young throughout the day. Walking about on a rookery is a matter of no mean difficulty. The ground, always loose and powdery, is everywhere perforated with holes from two to three feet deep, about the diameter of a rabbit-burrow. Among the long grass it is almost impossible to prevent crushing down the sand and endangering the lives of the young birds by suffocation, at the same time falling headlong oneself. Just at sunset I was invited to go some two hundred yards up on to the higher ground—the island is only 200 acres in extent—in order to see the birds come in. I shall never forget that evening as long as I live. The sun was setting, leaving a broad belt of crimson on the western horizon, and soon the surrounding sea became almost invisible. Not a sound was heard except the rustling of the grass in the wind. There was no indication that there was a living thing on the island. There were no cries of sea birds. The stillness was wonderful. Presently a single dark-winged form flitted across the island and vanished again into the gloom. In another ten seconds thousands upon thousands of birds seemed to spring like magic up out of the darkness from every quarter without warning or cry of any kind. And now backwards and forwards before my dazzled sight I saw these countless dark shadows shooting with lightning rapidity athwart the last of the evening light. Still no articulate sound was heard. Nothing but the whistle as if of bullet after bullet through the air, bewildering one with the sense of numbers and of mysterious rushing life. Repeatedly a bird would dash within an inch of my head, and then wheel like lightning to one side to escape a collision. So imminent seemed the danger of arriving at home minus an ear or a nose from contact with a sharp beak that I was fain to crouch down in the long grass to escape an accident. To sit down on the ground on that particular island was possible because there were no snakes. Nothing would have induced me to have taken up the same position in the month of March had I been upon the island called "Hummocky." But of this hereafter. The minutes passed, and still this dizzy, whirling, hurly-burly of creatures continued—silent, and even awe-inspiring. Sometimes they came in squadrons of hundreds, sometimes by tens. But still they came; each bird after a turn or two sinking with unerring instinct on to its hole, finding it in the long grass and in the darkness with a certainty which was truly marvellous. It was difficult to tear oneself away from this wonderful spectacle. But at length we returned to our tent, pitched near the water's edge but still among the bushes, and all night long as I lay trying to sleep I heard the cooing and cackling of innumerable birds feeding their young in their subterranean homes, some of them apparently within a yard of my ear. At length I fell asleep, and before I awoke, at 6 o'clock in the morning, there was not a bird to be seen on the island. All the old petrels had long ago sped away to their distant feeding places. I regretted that I had not witnessed their morning exit. In its way it is as striking as their homeward journey. For, as these birds cannot fly off the ground, especially in the long grass, each one has to walk either to the sea shore or else to the top of some rock before it can take its flight. In some cases this journey must have meant a distance of many hundred yards. Mr. Davies relates in his paper, read in 1846, that the sealers showed him the manner in which they caught the old birds for the sake of their feathers, stopping up all the tracks they made except one, which led to a pit into which they fell, and were suffoeated by those that crowded after them. I am thankful to say this custom does not obtain at the present time. On every occasion when I could take the opportunity I used to take up my position upon the rookery to watch for that wonderful silent rush of birds after dusk. It never ceased to charm as well as to astonish.

I will proceed now to give you some statistics regarding the numbers of these birds, based on personal enquiries from those who live by this industry. On Chappell Island on Sunday morning, March 8, after morning service, I collected all the heads of families of the half-castes, and extracted the information I am about to put before you. But first to prepare you for some astonishing figures, I quote what has been said already on this question. Mr. Davies writes that so great were the numbers of the birds returning to Green Island that "night is ushered in a good ten minutes before the usual time." And again—"I have actually sailed through them from Flinders Island to the Heads of the Tamar, a distance of 80 miles." And Flinders calculates that he passed through a flock which must have been 40 miles long. We have fallen upon degenerate days. There are whole islands absolutely deserted now which formerly swarmed with these interesting and lovely creatures. Witness Gun Carriage, or Vansittart Island, as it is called. Not a single petrel ever breeds there now, because of the culpable negligence and cruel thoughtlessness of settlers in old days. They put cattle on the island, and I confess that my indignation rises when I think of the slow agonies endured by thousands of these defenceless young birds crushed to death in their holes under the heavy tread of bullocks. I stand amazed both at the cruelty of such conduct, and at the want of foresight among the farmers. For when once the cattle are regularly placed on one of these islands the birds desert it in a body; and there is no expedient by which they can be attracted back again. So far as it is known they depart never to return. When it is borne in mind that a man and his family can earn about £4 10s. a day for nine weeks in an industry on which he actually spends nothing, which only needs that it should be left severely alone until the moment for catching the birds has come, you will wonder how anyone can be so infatuated as to turn, say, some 20 head of cattle on an island which might otherwise produce 100,000 birds annually, to be sold at an average of 10s. a hundred. This infatuation has not ceased. The islands, some of them, are being ruined at this moment, and I earnestly trust that my voice, together with that of others, will succeed in saving a wonderful industry before it goes the way that the sealing industry has nearly gone, through sheer neglect of the dictates of common sense.

On that Sunday morning I learnt that on Chappell Island (which has an area of 1,200 acres, including rocks and sand patches) there were, in 1890, 21 families at work catching the young birds for some eight weeks, beginning about the 18th day of March. They caught and salted 204,000 birds. I asked—"Did you take them all?" "No, that is impossible. We go over the holes twice, and find just as many the second time as the first. At least 100,000 young birds must escape. When the time comes for their flight the sea is covered with them." Let us consider that 100,000 young petrels then escaped. This brings our total of young birds to 304,000, neglecting those which meet with untimely deaths. Now, each pair of mutton birds lays but one egg. Therefore at the lowest computation (putting aside all barren pairs and those which had lost their eggs or young) there must have been 608,000 old birds. But this is not all. The 21 families of half-castes on Chappell Island live entirely on these birds during their season. I made a calculation with them which showed that from six to ten birds a day is the ordinary allowance for a man; and besides the human beings to be fed there are three or four kangaroo dogs to each hut, who all have to be supported on the same diet. In the two months of their stay these people ate at least 26,000 young birds. And, lastly, the parents of these young ones so eaten amounted to 52,000. So, then, we are well within the mark when we say that on any night in February there were in 1890, on Chappell Island alone, 990,000 petrels. We are accustomed to be told of the wondrous wealth added to our food resources by salmon, which cost nothing but a little watching, and come back from the sea ten times the size they went for the sake, apparently, of feeding mankind. I submit that the mutton birds are a case equally in point. That the young fresh birds are delicious eating I can testify. They taste like a very fresh herring as we know that fish in the Old Country. Broiled or fried it is a dish to set before a king. When salted they are unquestionably nutritious, and probably quite as healthful also, for delicate persons, as cod liver oil. A little barren treeless hummock in our seas produced then last year £1,020 in cash. Destroy that rookery by letting some dozen cattle roam over it and a few sheep and what is the result in the eyes of any reasonable person? What a loss to the wealth of the colony? On this very island there is a farmer who owns 40 acres of land. This he stocks with cattle and sheep. His fence runs right across the track from the only good harbour to the largest cluster of huts. The half-caste lads pull down a panel sometimes. The cattle roam over the rookeries. I have seen them there myself, and I have thought, while viewing the present state of things with regret, how easily the island could be saved from the destruction which is impending.

But to return to numbers. Little Dog Island is in private hands on a Government lease. Three families each take some 27,000 birds off patches of 40 acres in each case. To those interested in the condition of the ground for walking I make the following calculation:—On 40 acres here there must have been 40,000 holes occupied by birds, besides deserted nests. One party on Big Dog Island collected last year 40,000 birds. This island does carry cattle, but it is quite different to the other rookeries. There is a large wood at one end, and the ground is a great deal harder, the birds breeding only at one end of the island. Babel Island probably contains more birds than any of these other places. It is at the S.E. of Flinders. But the snakes are so terrible here that even the half-castes do not like working on it. Two families, however, have attempted it this year. If we take the birds on these four little islands we shall be below the mark when we compute that on any night in February there are two million six hundred thousand sooty petrels asleep upon them.

Perhaps it will interest the members of the Society to hear of another feature of these islands. I remarked that no one on Chappell Island was ever seen without a stick or a gun. It was an ominous sign, betokening the presence of snakes. These creatures do not live apparently on mutton birds, but on mice, which abound there. The young men spend Sunday morning sometimes in killing snakes. Two parties the other day started out to see how many they could get—one party brought in 100, the other 70. Nor did any one in the islands to whom I mentioned this think it an extraordinary case. One man, old Mr. Smith, the half-caste, told me that his party one year threw into a heap the snakes they killed in the two months in the course of their work, and that they numbered 600. When you consider that a man in his prime can take 1,000 birds out of 1,000 holes, in any of which there may be snakes, it indicates the nerve that is needed for this industry. As a matter of fact they rarely touch a snake by accident. There are sure signs of their presence; nor are they often in the holes where the young birds are; and these inhabited holes have also their signs. At the same time a girl of 16 pulled out two snakes in one day a year or two ago; but, then, she was inexperienced. Sleeping on the ground among the bushes on Chappell Island on that Sunday in a hut without a door, and open on every side along the ground, I was not surprised when, after an hour, I heard my companion muttor, "I am too nervous to sleep here: I am off to the boat." For my own part, though I braved it out, I was glad when the first streaks of dawn appeared in the east.

Chappell Island is bad enough, but the half-castes say that Babel is so bad that, though a moderate fortune awaits them there, they do not care to go. I may add that so barren are these hummocks that every family commences operations by stacking wood for two months, loading their boats on Flinders Island, and filling casks of water. There is neither water nor fuel in these places. I have spoken of petrels and of snakes on these islands. I could a tale unfold about another inhabitant, exceeding in numbers even the mutton bird, but I forbear. I merely allude to the dread subject of fleas. I leave to your imagination, which you may actively employ without easily overstepping the bounds of reality, the details of this theme which in that neighbourhood you can by no means put away from your thoughts—and feelings.

What practical proposals, then, can be made for the due protection of mutton birds? I have discussed the question with magistrates in the islands, with all the half-castes, and with white settlers. I think I may say that there is complete unanimity among them all. There is no doubt what should be done. One and all call for restriction. On one occasion, a fine, stalwart fellow, a half-caste, and one of the best boatmen in the world, was urging restriction. What he really said was—"I wish, sir, when you return to Hobart, you would put *strychnine* upon them." What is the sort of "strychnine" we want?

First: The wisest plan would be for the Government to resume possession of the mutton bird islands. Some are now let on lease, such as Little Dog and Big Dog. One is in a sense reserved for the half-castes, namely, Chappell Island. But on this island two white families own small patches of land, which they have bought. In both cases I believe they are honourable men, and have no wish to go beyond their rights. Why should they not be bought out? It would be but a trifling sum, and the islands afterwards would be a regular source of revenue. Some islands, like Babel, are practically untouched by anyone.

Secondly: If resumed by Government, why should not a license be taken out by every person who wishes to "bird"—so much for an adult, say, 10s., and a lesser sum for the younger members of the family? At least £100 a year could be received at once from this source of revenue. But even if the Government does not resume possession (and I, for one, earnestly trust they will take them entirely into their own hands), still the points, which are simply dictates of common sense, are these—

(*a*.) That there be a close time for these birds, just as there is a close season for quail: At present there is none.

(*b*.) That no egging be permitted. The waste in past years, and even at this time, is terrible, and there is practically nothing gained by the taking of the eggs, whereas the number of birds is materially lessened. Formerly they were eaten in large numbers. Mr. Davies states that an officer of the old settlement on Flinders saw a woman eat 52 eggs in one day. As they are as large as ducks' eggs that was a first-rate performance.

(*c.*) That a fixed day should be gazetted before which no one should be allowed to touch a bird. Persons differ whether it should be March 15 or any date up to March 20. There is great need for such an order. Families on Chappell Island have no recognised spaces on the rookery. They begin upon the same day, each near his own hut, and work outwards and upwards as they please. If one man begins too early the others are compelled to work in self-defence. There is no need to fix the close of the season. The birds arrange that by flying clean away about the middle of May, and not returning till September.

(*d.*) No fatting should be permitted. Fatting means taking the immature bird before it is ready for salting, and boiling it down for the oil. As 200 birds make about a gallon or so of oil, which brings 3s., and as those 200 birds a week or two later would sell when salted for £1, the unwisdom of the former operation is obvious.

(*e.*) No cattle or sheep should be permitted on these islands. Big Dog Island may be an exception, but there is no question the other little islands should be protected. I know how many in this colony are enrolling children in Bands of Mercy in order to teach them to be gentle and kind to all animals. I have heard of a "Dicky Bird Society," which exists for similar purposes. I invoke the aid of all such in the cause of the gentle and inoffensive "yolla"—that is the native name for the sooty petrel or mutton bird. I invoke the aid also of all who have been fascinated by the exquisitely graceful flight of these birds as they soar and wheel round the passenger steamers that ply round our coasts. The mode of killing them for the industry is painless; one twist of the neck and they are dead. A single pressure on a gland in the stomach after death and the oil escapes at the mouth and is caught in a vessel. This is legitimate, and not barbarous, for we must kill in order to eat. But it shocks all our finer feelings to think of cattle trampling upon hundreds of young birds, which die and rot uselessly in their holes.

(*f.*) An order should be issued against fires, except between May and September. It is, of course, difficult, but not impossible, to get the grass to burn in winter. At any other season it means ruin to the industry and death to the petrels.

(*g.*) Chappell Island, in consequence of the cattle that have been on it, would be the better for a year of rest. All agree as to this. But the question arises, "Where shall the half-castes go for this one year?" Could they attempt Babel? Could they go to some of those islands off Wilson's Promontory, which are said to swarm with birds, and no one touches them? I am told there are not even boat harbours in them. At any rate, Chappell Island, as being in some sense reserved for the half-castes, merits our chief attention. There need be no difficulty in carrying out these arrangements. Under the direction of the worthy magistrates in the islands and the well-known police constable everything could be at once arranged. If it is asked why such obvious regulations have not been made long ago, I answer that perhaps the chief reason is that never have these islanders recorded a vote for a member of Parliament. There has been no polling station, no registration office for them. I have wondered why a would-be member for Ringarooma (in which district the islands are included) has never bestirred himself to get fifty solid votes from the Furneaux Islands, votes which would be gladly given to anyone who would advocate their just claims and protect their industries.

If anything I have said leads to a greater interest in one of the most beautiful of our sea birds, and indirectly helps to foster a useful industry, and further the cause of humanity in the protection of the "yolla" or sooty petrel, through the instrumentality of the Royal Society, I shall have deemed it an honour as well as a privilege to have put this paper before you this evening.

DISCUSSION.

Mr. MORTON said that the value of the mutton bird industry had never been so prominently brought before the notice of the Society since Mr. Davis read a paper on the subject, which was printed in the Tasmanian journal. He looked upon it as a matter which might very well engage the attention of the Fisheries Board. He would very much like to find out from statistics whether this wholesale destruction of the petrel had decreased the numbers. As far as he was able to gather they had not decreased. It was plain, however, that were cattle were introduced the birds had disappeared and gone to some other place. Viewed as an important industry, he thought these birds should be protected, especially as it was thought necessary to protect quails, which brought no revenue into the country, but merely provided sport.

Mr. Bernard Shaw said that there was already an Act of Parliament enabling the Executive to deal fully with the matter. It was passed last session, and there did not appear to have been sufficient time to prepare the necessary regulations. Under that Act the Governor-in-Council was empowered to make regulations fixing a close season for the birds, preventing the introduction of cattle and sheep to certain islands, the lighting of fires, and various other matters to which His Lordshp had referred in his paper. He considered that interference in these matters was beyond the functions of the Fisheries Board. The Act to which he had referred gave ample powers to make all the regulations necessary, and he hoped that before next season there would be a complete set of regulations in operation.

Mr. Alfred J. Taylor said that before Bishop Sandford left the colony he brought this matter under the notice of the Society, and pointed out that a valuable industry was being destroyed. He had also referred to the fact that the oil of the bird had been found valuable as a medicine in cases of consumption.

Mr. R. M. Johnston said that having visited these islands on several occasions he could corroborate His Lordship's description of the return of the birds. It was a glorious sight to see the multitude of birds returning, and he was glad to see that steps were being taken to see what could be done to protect these birds. In regard to the destruction of the birds, he thought this arose not only from the destruction of the birds, but also of the mounds in which they burrowed.

His Lordship briefly replied, expressing pleasure at the fact that legislation had been initiated in the direction indicated, and hoping that the necessary regulations would be framed to protect what he regarded as an important industry.

NOTES ON A COLLECTION OF PLANT IMPRESSIONS FROM THE HENTY RIVER.

By R. M. Johnston, F.L.S.

Lower Coal Measures.

Until very recently we were ignorant of the existence of the extension of members of the Carboniferous Rocks to the west of the Eldon Bluff. About six months ago I received a collection of fossils from Mr. T. P. H. Jones, taken from a deposit extending eastward along the northern side of the Henty River, commencing at its junction with its tributary, The Badger, and apparently occupying a patch of about 4 miles square, lying between these rivers eastward of the fork. Mr. Jones states that he has traced some of its members forming a narrow curved strip bending northwards towards, and nearly approaching the vicinity of Mount Dundas.

Mr. Montgomery also visited the locality at this time, and we may hope to learn from him further particulars regarding the stratigraphic relations of the various members of this deposit at an early date. Having expressed to Mr. Jones my desire to obtain a more complete collection of the plant impressions, he very kindly undertook to do so, and recently, through the kindness of Mr. Meiring, I received a collection of Lower Coal Measure plants, containing some of the finest examples of *Glossopteris Browniana* that I have yet seen in Tasmania. One of these is nearly perfect, and must have been originally 14 inches in length, having a breadth of $2\frac{7}{8}$ inches at its greatest diameter.

Another fine example of *Glossopteris*, which I regard as a new species, is 9 inches in length, and 4 inches broad at its greatest diameter. These beautiful ferns are very remarkable, and are associated with abundant remains of the following species—all of which also occur in the shales of The Lower Coal Measures at the Mersey River: viz.:—

Gangamopteris spatulata. M'Coy.
———— obliqua. „
Noeggerathiopsis media. Ettings.

The shales in which these plants are imbedded are hard and fissile, and of a very dark grey colour. They contain many curious botryoidal concretions; some rounded or nut-shape, and all of them having a bright glazed surface. I am yet unable to account for them.

Intimately associated with these shales occur fossiliferous mudstones and impure limestones identical with similar deposits in the Mersey, and throughout the eastern part of Tasmania.

The more numerous fossils in these beds are the following:—

Spirifera Tasmaniensis.
——— avicula.
——— convoluta.
Sanguinolites Etheridgei.
Fenestella internata.
——— plebeia.
Protoretepora ampla.
Stenopora Tasmaniensis.

There can be no doubt, therefore, that these beds are the equivalents of the Coal Measures of the Mersey, and there is some hope that Mr. Jones may be successful in his search for coal in this neighbourhood.

LIGNITE BEDS.

Mr Jones informed me that the Coal Measures at the Henty are flanked by beds of lignite, and among the specimens sent to me were several small fragments of lignite, no doubt obtained from the same place. On examination I was successful in obtaining casts of two or three new leaf forms. One of the forms is undoubtedly a species of *Fagus* with very minute leaves, closely allied to the existing *Fagus Cunninghami* of Tasmania. Another is a well-preserved impression of the phyllodium of a species of Acacia, closely resembling the existing *Acacia melanoxlyon.*

Descriptions of the principal forms of the Lower Coal Measures, together with these of the Tertiary lignites, are given hereafter.

One of the forms I have named *Fagus Jonesii,* in honour of Mr. Jones, to whom we are indebted for their discovery. Another has been named *Acacia Meiringii,* in honour of Mr. Meiring, to whom also I am indebted for placing such a fine collection at my disposal. The close resemblance which these two forms bear to existing species, incline me to the opinion that the lignites at this place are of a more recent date than any other lignite formation hitherto described.

GLOSSOPTERIS BROWNIANA.

Frond lanceolate-elongate, obtusely acuminate; costa thick, gradually diminishing, but extending to the apex; veins, close parallel, ascending from costa acutely, at an angle of about 50 deg., and gradually curving outwards, where they emerge at an angle of 30 deg. Anastomoses, long and narrow, only slightly broader close to the mid-rib. Large specimen, 14 inches long; breadth at greatest diameter, 2⅞ inches. Locality, dark shales, associated with Carboniferous Marine Beds, near junction of Henty and Badger River.

Glossopteris ovata. *Nov. sp.*

Frond, broadly-ovate; margin, slightly undulating; apex rounded, not produced; costa, moderately thick towards base, diminishing, but extending to apex; veins, closely parallel, diverging from costa at an angle from 11 deg. to 22 deg.; anastomoses, obscure, but do not appear to be frequent. Specimen, 9 inches long, greatest breadth at middle of frond, 4 inches. The broad, rounded form, obscure anastomoses, and the low angle at which the sharp veins diverge from mid-rib, seems to justify the separation from G. ampla to which it is most closely related.

Locality.—Henty River Lower Coal measures.

Fagus Jonesii. *Nov. sp.*

Leaves, very minute, shortly petiolate, broadly ovate or deltoid, flat, or slightly convex, coriaceous: margin, strongly dentate: mid-rib, somewhat prominent: primary veins, scarcely visible. Lignite Beds, Henty River.

Acacia Meiringii. *Nov. sp.*

Phyllodium, lanceolate: apex obtuse, narrowed towards the base; slightly coriaceous, with five fine longitudinal nerves.

Anastomosing veins appear to be much closer and finer than in the existing *A. melanoxlyon* with which this form seems to be closely allied.

Length, 3⅞ inches; breadth at middle, ⅞ inch.

Locality.—Lignite Beds, Henty River; associated with leaves of extinct species.

BRIEF REMARKS ON SOME RARE TASMANIAN PLANTS.

By Baron Von Mueller, K.C.M.G., M.D., Ph. D., F.R.S.

Coprosma Petriei, Cheeseman in the transact. of the N.Z. Institute, XVIII., 316 (1886).

Under this name I wish to bring under notice what appears to be a new Tasmanian Coprosma, lately found as of rare occurrence by Mr. T. B. Moore on the highlands east of Mount Tyndall. It has the same very depressed matted growth as C. repens (C. pumila), also very small leaves and terminal small-sized fruits. But the leaves in all the specimens received are decidedly pointed, indeed ovate-lanceolar, and the fruit is beautifully blue outside, a characteristic which separates this species from all other Australian kinds, and which is not likely subject to variation. Mr. Thomas Cheeseman in his excellent review of the 31 New Zealandian species of this genus distinguished by him, mentions two as having fruits blueish outside, namely C. parviflora and C. acerosa, the former otherwise very different from our plant, the latter of much larger size, with puberulous branchlets and longer but narrower leaves. Nevertheless C. Petriei is described as varying in the outside colour of the fruit, red in the Nelson, blue in the Otago province, but possibly two species became thus confused, in which regard already some indications are given in the transact. of the N.Z. Inst. XIX., 251 and 252. As the flowers of this plant are not yet known, it remains for some future opportunity to confirm the differences existing in this respect between C. repens and C. Petriei. The fruits are globular or verging into an oval form; so far as seen on this occasion they ripen only one, rarely two seeds. The embryo is only half as long as the albument. Should the Tasmanian plant, after the flowers have become known, prove a peculiar species, then such ought to be distinguished under the finder's name.

Panax Gunnii—

The fruit of this rare shrub was also for the first time obtained for me by Mr. T. B. Moore, who gathered it in deep shady gorges at Mount Lyell, on the Canyon River, the Franklin River and on a tributary of the Pieman's River. It is succulent, about $\frac{1}{3}$-inch broad, renate-roundish, turgid, black outside, at the summit five-denticulated and impressed, so that the styles are hardly visible; the two nutlets inside are oblique-ovate or demidiate-roundish, about ⅙-inch long, rather turgid, exteriorly grey-brown and nearly smooth. This plant seems to bear flowers already, when only 6in. high, and never to exceed 4ft. in height, unless perhaps in cultivation.

Styphelia Milligani—

Under this appellation occurs the Pentachondra verticillata in the second systematic Census of Australian Plants p. 178, in anticipation of the fruit proving that of a Styphelia (or Leucopogon), a surmise fully borne out by specimens sent by Mr. Moore from the highlands of Mount Read and Mount Tyndall, where also a small form of Acacia mucronata is growing at elevations between 3,600ft. and 3,900ft. The fruit, as now seen, is only of about ⅛-inch measurement, nearly globular; its pericarp is very thin and outside white; the putamen is five-celled. Possibly the fruit obtained may be over-aged. Until now the plant was only known from Dr. Milligan's collection. It is from 6in. to 18in. high, but as it is many-branched from the root, Mr. Moore saw individual plants covering a breadth of 2ft. When out of flower this plant calls to mind, as regards its aspect, some Pultenæas.

It may here not be inappropriate to remark that since Sir Joseph Hooker finished, in 1860, his superb work on Tasmanian plants, the following were by me brought under notice as additional among vasculares (they coming within the scope of my own researches) as the Tasmanian flora could not be kept apart in treating that of Continental Australia, some few only emanating from other collections:—

Papaver aculeatum, Thunberg.
Cakile maritima, Scopoli.
Pittosporum undulatum, Andrews.
Comesperma defoliatum, F. v. M.
Elæocarpus reticulatus, Smith.
Pseudanthus ovalifolius, F. v. M.
Euphorbia Drummondi, Boissier.
Casuarina bicuspidata, Bentham.
Zieria cytisoides, Smith.
Zieria veronicea, F. v. M.
Eriostemon Oldfieldi, F. v. M.
Atriplex paludosum, R. Brown.
Polygonum lapathifolium, Linné.
Acacia penninervis, Sieber.
Acæna montana, J. Hooker. (Recorded as a variety in the Fl. Tasm.)
Pimelea Milligani, Meissner.
Pimelea stricta, Meissner.
Pimelea axiflora, F. v. M.

Pimelea serpillifolia, R. Brown.
Eucalyptus Sieberiana, F. v. M.
Eucalyptus Stuartiana, F. v. M.
Panax sambucifolius, Sieber.
Hakea ulicina, R. Brown.
Hakea nodosa, R. Brown.
Coprosma Petriei, Cheeseman.
Cotula filifolia, Thunberg.
Calocephalus citreus, Lessing.
Cassinia longifolia, R. Brown.
Podosperma angustifolium, Labillardiere.
Ixiolæna supina, F. v. M.
Leptorrhynchus nitidulus, De Candolle.
Helichrysum Spiceri, F. v. M.
Helichrysum Gravesii, F. v. M.
Anaphalis Meredithæ, F. v. M.
Lobelia platycalyx, F. v. M.
Lobelia rhombifolia, De Vriese.
Lobelia Browniana, Roemer and Schultes.
Lobelia microsperma, F. v. M.
Lobelia pratioides, Bentham.
Leeuwenhoekia dubia, Sonder.
Donatia Novæ Zelandiæ, J. Hooker.
Scævola æmula, R. Brown.
Scævola microcarpa, Cavanilles.
Goodenia barbata, R. Brown.
Styphelia elliptica, Smith.
Styphelia scoparia, Smith.
Solanum vescum, F. v. M.
Veronica plebeja, R. Brown.
Veronica notabilis, F. v. M.
Westringia rosmariniformis, Smith.
Verbena officinalis, Linné.
Myoporum parvifolium, R. Brown.
Prasophyllum nigricans, R. Brown.
Pterostylis vittata, Lindley.
Orthoceras strictum, R. Brown.
Caladenia suaveolens, G. Reichenbach.
Thismia Rodwayi, F. v. M.
Milligania Johnstoni, F. v. M.
Potamogeton perfoliatus, Linné.
Potamogeton Cheesemani, A. Bennett.
Potamogeton pectinatus, Linné.
Zostera nana, Mertens and Roth.
Lepyrodia Muelleri, Bentham.
Calostrophus elongatus, F. v. M.
Schœnus Tepperi, F. v. M. (or a closely allied species.)
Heleocharis acicularis, R. Brown.

Gahnia Radula, F. v. M.
Carex tereticaulis, F. v. M.
Carex Bichenoviana, Boott.
Sporobolus Virginicus, Kunth.
Agrostis frigida, F. v. M.
Agrostis Gunniana, F. v. M.
Zoysia pungens, Willdenow.
Imperata arundinacea, Cyrillo.
Cyathea Cunninghami, J. Hooker.
Blechnum cartilagineum, Swartz.
Asplenium Hookerianum, Colenso.
Aspidum hispidum, Swartz.
Hymenophyllum marginatum, Hooker and Greville.
Hymenophyllum Malingi, J. Hooker.

In the concluding pages of the "Flora Tasmaniæ" were already inserted solely from Melbourne communications as additional.

Kennedya monophylla, Ventenat.
Geum renifolium, F. v. M.
Aciphylla procumbens, F. v. M.
Leptomeria glomerata, F. v. M.
Abrotanella scapigera, F. v. M.
Senecio primulifolius, F. v. M.
Senecio papillosus, F. v. M.
Dracophyllum minimum, F. v. M.
Sebæa albidiflora, F. v. M.
Limnanthemum exigeum, F. v. M.
Dendrobium striolatum, G. Reichenbach.
Selaginella Preissianum, Spring.

THE POSSIBILITIES OF THE TELESCOPE.

By A. B. Biggs.

Up to about the end of the 15th century mankind was in a condition of helpless ignorance with regard to the nature, the distances, and the dimensions or (except two) the form of the various bodies which constitute the visible universe. No human eye had ever beheld either stars or planets as other than dimensionless points. Their motions and positions had been carefully observed, systematised and theorised upon; but they were unapproachable. What a wonderful revelation then must that have been which *Galileo's telescope* opened up! practically diminishing the distance some 20 or 30 times. True, his was a very simple affair, and feeble in its infancy; but it revealed some most important facts. It served to show that the planets at least were globes, some of them of vast bulk: it opened up to human vision for the first time the wonderful mountainous scenery of the Moon. But perhaps its most important service was to establish beyond question the Copernican theory of astronomy by revealing the phases of the inner planets—also the moons of Jupiter—a Copernican system in miniature.

The Rings of Saturn constituted an inscrutable riddle, reserved for further development of this new power of vision.

Since Galileo's time, the effort has been constant and unwearying to develop to the utmost the power of the instrument. There were difficulties inseparable from the principle on which the instrument is constructed, which it was long thought never could be overcome, the chief of which was (briefly stated) that a ray of light, when bent out of its course, as by a prism, or a lens, is separated into its different component colours, each having a different focus. The discovery and utilisation of the fact that different kinds of glass have different separating or prismatic effect, led to the construction of the *achromatic* object glass. This gave a new start to the powers of the instrument, so that we have reached from Galileo's power of 30, and imperfect at that, to a power ot about 3,000 in the Lick Telescope.

Well, now the question arises:—If we have from the time of Galileo been enabled by the gradual improvement of the telescope to stretch our gaze farther and farther into space, why should we not still go on enlarging its scope. As we now see clearly the configuration of the lunar mountains, why should we not, in time, come to see the trees growing upon there sides, if there be any? Why not discover signs of organised existence, if such exist? Is there any limit to which the instrument is capable of being developed. This is the question which it is natural to ask, and which I have been asked repeatedly. On this account I have thought it might be deemed an interesting question to discuss.

I may state at starting that doubtless there *is* a limit, and moreover, I believe that limit is already nearly, if not quite, attained. To prepare the ground for a clear understanding of my reasons, I must very briefly refer to the fundamental principles of the telescope. A luminous body, such as a star, emits rays diverging in all directions in straight lines. Of course the greater the distance the more these rays are spread; that is, the light is diminished in intensity, and that in proportion to the *square of the distance*. Of the total light emitted that received by the eye is that fraction which the pupil bears to the whole sphere of which the radius equals the distance. These rays may be so enfeebled by distance that the object ceases to be visible. Now, if we can gather a sheaf of these rays that would otherwise pass by us unperceived, and bend them inwards until they enter the pupil of the eye, we evidently increase the visible luminosity in that proportion. This is the function of the object glass—*i.e.*, the large glass at the outer end of the telescope—or the speculum of the reflecting telescope (See Fig 1).

Of course, the larger the glass the more it can gather. As the rays from every point of the object are brought to a corresponding point at the focus of the lens, a small image of the object is formed. This image is magnified by the eyepiece, which is really a *microscope*. But whether we magnify this image less or more, we have only the same amount of light to deal with, viz., that which is grasped by the object glass; and the more this light is spread out by magnification the more it is enfeebled. This magnification is therefore limited by the capacity or size of the object class—(other things being equal). In this respect the Telescope and the Microscope stand on a very different footing. We cannot, of course, increase the actual luminosity of a celestial object in the smallest degree. All we can do is to grasp as much as possible of the light actually emitted. With the microscope, on the other hand, we can, by means of condensers, and the employment of suitable sources of light, increase the illumination of the object indefinitely up to the required amount of amplification. Hence it is evident that increase of *telescopic power* is to be sought in the *enlargement of the light gatherer*—the object glass. But this is where the trouble comes in. The difficulty of accurately figuring a large object glass, or speculum, increases enormously out of proportion to its dimensions. If every point of its active surface does not refract or reflect its ray to its exact point in the focus, such defective part is worse than useless. To give some idea of the nicety of manipulation required, I may state that a speculum is ground and finished up to the finishing touch of fine grinding, as a portion of the surface of a *perfect sphere*. But this figure would not do at all for the telescope. The marginal rays would be reflected to a different, that is, a *shorter* focus than the central ones. The radius of curvature needs to increase as it approaches the margin. The figure needs to be *parabolic*, answering nearly to the end of a long ellipse. But so little does this parabolic figure differ from the spherical, that it is all *done in the polishing*. And this is especially where the highest skill of the manipulator is called for. An extra rub with the palm of the hand may be sufficient to distort its figure.

Then another trouble comes in, increasing enormously with the size. We cannot get size without an immense increase of *weight*, and then comes the difficulty of supporting in their tubes these heavy masses without flexure or straining, the least degree of which is fatal to definition.

But now, supposing all these difficulties successfully overcome, there remains yet another obstacle, which is utterly beyond man's power or skill to contend with. We live at the bottom of an ocean of air; and we could not exist even if we could surmount it, any more than a fish could live out of water. And this ocean is in a state of ceaseless agitation, more or less. Through this medium must pass the rays which go to form the telescopic image. Some idea of the effect of this may be formed by trying to read the inscription on a coin lying at the bottom of a clear pool that is agitated by the breeze. I have viewed the planet *Saturn* in the telescope, when, from this cause, it presented the appearance of a fire-ball; huge tongues of flame apparently blazing all round it, flickering and dancing; precisely like those *kerosene fire-balls* which the boys throw up into the air with such magnificent effect on Queen's birth-nights. It was, to all appearance, a *world in a blaze*. It is not then to be supposed that we can, whenever we please, obtain a clear and distinct view of any celestial object we may wish to inspect. Favourable occasions for this are few and far between. Sometimes a lull in the atmospheric waves permits of a momentary glimpse of the object clearly and sharply defined; just as, in the case of the coin in the pool, a brief lull in the breeze allows you to begin to read the inscription; but before you get half-way through another puff comes up and blurrs it all over.

Now this difficulty increases with the size of the telescope, inasmuch as that the larger diameter takes in a greater number of these disturbing atmospheric waves; for which reason the observer has often temporarily to reduce the effective aperture, that is, the *power* of his telescope.

The only possible amelioration of the obstacle referred to is to leave as much as possible of this disturbing medium below the observer. This is just what is done in the case of the great *Lick Telescope*, which is erected on a mountain in San Francisco at an elevation of 4,300 feet, or about the height of the top of Mount Wellington. This, coupled with its vast size and perfect finish, places this instrument in the advance post of telescopic power. It has lately been proposed in France to erect an Observatory on one of the Alps, at an elevation of 15,000 feet. Owing to the compressibility of the atmosphere by the superincumbent weight of the upper strata the half of the entire mass lies somewhat below an elevation of three miles, although the rarer air probably extends considerably over 100 miles. But the necessity of air and warmth places a limit not far to reach in this direction. The most daring of balloonists ventured up to an elevation of about seven miles (I speak from memory), when one of the occupants became insensible, and his companion had only strength left to release the gas with his teeth, having lost the use of hands, and descend into a denser atmosphere.

Assuming that I have fairly stated the case, it would appear then that the smallest advance in telescopic power is necessarily to be obtained only at a cost enormously out of proportion to the gain, or, as it is commonly expressed, "the game is not worth the candle."

One word with reference to the announcement of a new optical glass for the manufacture of telescopic lenses, about which a deal of tall talk has been indulged, and probably not a few hoaxes, with more yet to come. This sort of talk springs from an entire ignorance of the function of any such glass and a supposition that some magical magnifying power is inherent in the glass itself instead of in the skill required to shape it. The function of such glass is simply to combine more accurately the different coloured rays, which existing combinations fail, to some extent, to bring to a common focus, the result being more perfect definition.

A brief explanation will, I think, serve to make this clear. *Light* passes in *straight* lines through a uniform medium. On entering a denser transparent body the ray is bent towards the substance of that body (See Fig. 2).

But what we see as *white* light is really composed of the blending of all the colours of the rainbow, together with some other rays, viz., the actnic or chemical rays and the heat rays. Now, these latter, together with all the different colours, are unequally "refracted" or bent. The light is, in fact, decomposed. Of the *light* rays the *violet* is the most bent, the *red* least. They are thus spread out into a band, along which the different colours are distributed. A simple lens, such as that of the primitive telescope, is *prismatic*. The effect is that the red rays are brought to focus at R, and the voilet to a shorter focus at V, the other tints lying between. Thus there is no definite focus (See Fig. 3).

We have, then, two effects from the passage of a ray through a *prism*—the *bending* or *refraction*, and the *decomposing* or *dispersion*. But the grand discovery was made that different kinds of glass *disperse* or spread the colours in different degrees with a given amount of refraction, thus:—If the former prism had been of *flint* glass instead of *plate*, and made to give the same amount of bending, we should have had the different colours spread over, perhaps, double the space. To produce an equal spreading of the colours we shall require a *flint* glass prism that will bend or refract *less*. We shall require to bend the ray only to B instead of to A (Fig. 2); that is, we shall require a thinner or less angular prism. Now, place these two prisms together in reverse positions, and what will be the effect? The ray will be partially brought back towards the straight, viz., to C instead of to A (See Fig. 2 b), leaving still an amount of deviation, from the greater thickness of the *plate* glass. But the dispersion of the colours is in *reverse* order in consequence of the inversion of the prisms, but in equal degree. The complimentary colours are therefore superimposed, and are re-composed into *white light*. This is the secret of the vast advance in telescopic power since the days of Galileo.

Now to apply this to the telescope. The lens (*P*) of *plate* glass (see Figure 4) is backed by a concave of *flint* glass (*C*) of less refraction power, thus leaving a surplus of refraction to the convex, the effect being that we get a focus at *F* instead of at *f*, with all the different coloured rays brought to a common focus.

Now, there is one trouble that has not yet been surmounted. Although the *general* prismatic dispersion may be equalised and neutralised, the colours are *unequally* distributed by the two kinds of glass. Consequently one particular coloured ray does not meet its exact complimentary in the reversed spectrum, and as a result we have a fringe of outstanding colour. This is called the "irrationality" of the spectrum. This is what opticians are endeavouring to get rid of by the invention of a glass that will locate the different colours in the same relative position as does the plate glass of the convex, and this is all the *magic* there is about it.

POSSIBLE POWER OF THE TELESCOPE.

I think many persons entertain very exaggerated ideas of what the telescope in its present stage can really accomplish. Theoretically it is assumed that the utmost available power of the most perfect instrument, and under the most favourable circumstances as to the state of the air, etc., is 100 to the inch of aperture. This is the *extreme*, rarely reached. The Lick Telescope has an object glass 36 inches in diameter. Considering the necessarily immense thickness of glass through which the light has to pass, we may assume 3,000 at the utmost of its power. This should, if definition were perfect, give us a view of the moon as at a distance of 80 miles. Of course this is a vast approach. But what could we see of the details of a terrestrial mountain, supposing we could discern it at 80 miles distance? This estimate is, of course, on the supposition that we could eliminate all optical imperfection and atmospheric disturbance, both of which are impracticable. In connection with this question I made the following experiment the other day:—I approached a handbill, of the subject of which I was ignorant, until I could just make out the boldest type. I found the distance 16 yards. The letters were bold block letters, 1 inch in height. Reckoning from this, similar letters on the moon's face, to be seen by natural unassisted vision, should measure 417 miles. There would be room across her face for a word of five letters. With a telescopic power of 3,000, and no imperfection introduced, such letters, to be readable, would have to be 244 yards. Each letter would thus cover a space of about 12 acres. Allowing for imperfection, I think this would be the smallest patch that would be discernible at all as to shape. At the distance of Jupiter this object would need to be about four million times larger in surface, or, say, three times the size of Tasmania.

PHOTOGRAPHY.

There is one direction, however, in which the powers of the telescope are in process of development to a considerable extent, that is, by its association with photography. I have so far dealt with the telescope as a *seeing* instrument. Whatever is to be seen is seen at once. We cannot increase its vividness or distinctness by prolonged gaze. If a faint star, *e.g.*, is not at once visible when the eye is directed to its position, any amount of staring at it will not bring it into view. Not so with *photography*. The more it looks the more it sees. In this way it has been arranged to explore the entire heavens to depths far beyond the limits of telescopic vision by combined effort of all the principal Observatories in the world. Already vast numbers of minute stars have impressed themselves upon the photographic plate that would probably for ever have remained beyond the power of actual vision. To accomplish this something more is necessary than merely focussing the object upon the photo plate. It has to be kept there accurately during the whole time of the exposure—a needle's point to a spider line—and that for hours, against the diurnal motion of the earth. To give the proper motion to the telescope the most accurately constructed driving clock-work is necessary. For planetary detail, however, I much question if photography will ever render much service. There is no getting over the blurring caused by atmospheric disturbances, superadded to instrumental imperfection. The photo of moon from the great Melbourne telescope is generally accounted one of the most successful ever produced. But in this, minute details that are distinctly visible in either of my comparatively small telescopes are totally absent.

A few remarks on the necessity of *caution* in rightly interpreting telescopic appearances may fittingly conclude this paper. A novice on taking his first peep at the planets, we will suppose, will probably feel quite disappointed that the object he sees exhibits very little of the detail or appearance of that same object as depicted and described by experienced observers, and after long and diligent observation. The eye requires considerable training for this kind of seeing. Moreover, considerable judgment is necessary in rightly interpreting what we see.

ERRATA (IN PLATE).

Omit the words "Page A," etc.

"In FIG. 2 *b* add a dotted line (A) from prism, above C."

Figures for

Page 3 "Possibilities of the Telescope.

FIG 1.

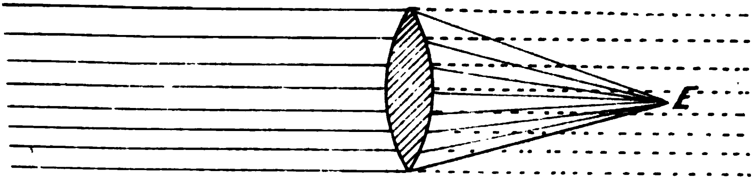


FIG 2.
Page A.

FIG 2b
Page A.

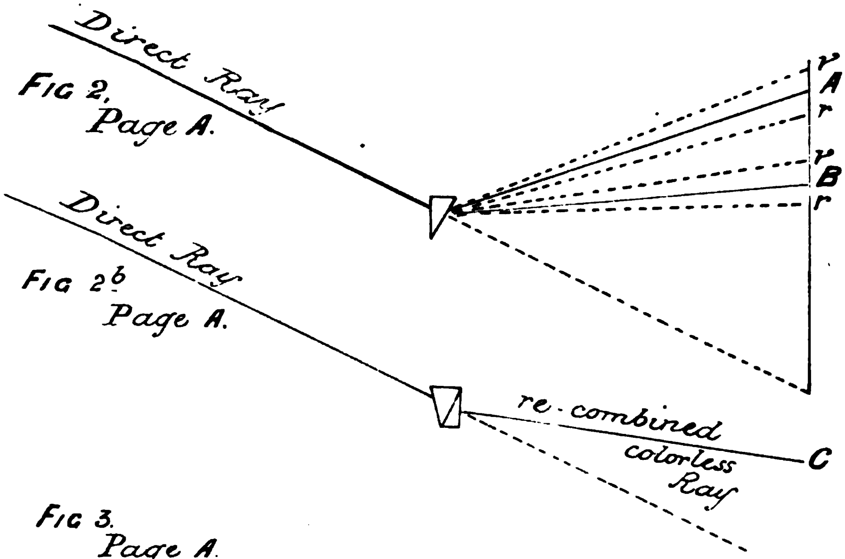


FIG 3.
Page A.

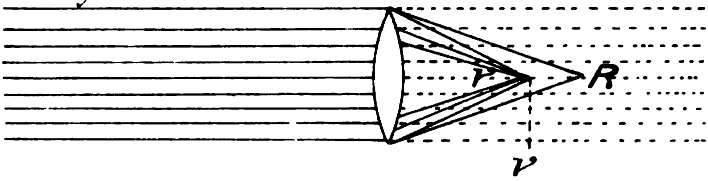
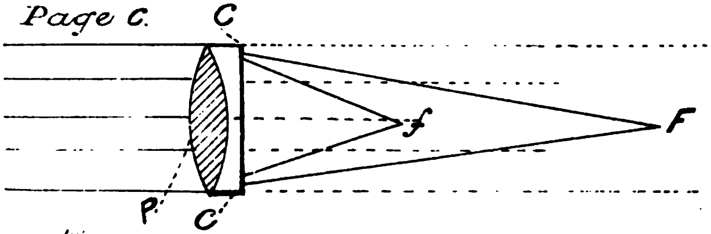


FIG 4.
Page C.



Mercury. Litho.

NOTES ON THE MOUNT LYELL DISTRICT, TASMANIA.

By Frederick Danvers Power, F.G.S.

(Corresponding Member Royal Society of Tasmania.)

On taking a casual glance at the geologically coloured map of Tasmania we are struck with its similarity in appearance to some huge concretion, for we see a nucleus of greenstone, which is surrounded more or less by a ring of the upper coal measures, and these again by rocks from other epochs.

If instead of the geological map we take a topographical one we will observe the same onion-like structure. In the centre we find the Lake Plateau country, from which the river systems of Tasmania radiate. Encircling this are various ranges of mountains, and finally we have the sea coast, which has practically the same contour as the kernel, making due allowance for irregularities, which would be exaggerated by enlargements. Looking at the island as a whole, it is heart-shaped, and somewhat similar in outline to the continents, inasmuch as it is widest at the northern and narrowest at its southern end, its length being north and south. The geological and topographical features coinciding so closely, we are naturally led to the conclusion that they must in some way or other be intimately related. If we can further connect our ore deposits with the physical developments of the country we may gain something by our studies with which the strictest utilitarian cannot find fault.

Orography.

Mr. R. M. Johnston supposes that many of the Tasmanian mountains are due to the shrinkage of the earth's crust; but it has long since been proved that the elevations of our mountains are far in excess of that required by the cooling of the world, and although some slight puckering of the surface may be due to this cause, still I believe it will be generally conceded that other agencies are also at work, and that the presence of the ocean is the greatest of these.

We almost invariably find that the highest mountain ranges have been developed more or less parallel to the past or present sea coasts that are washed by the largest bodies of water. Thus in South America we find the Andes on the west higher than the mountains of the east coast; also that the western shores of America are washed by the Pacific Ocean, which is greater in area and depth than the Atlantic, which is on the eastern coast. Coming nearer home for an example, we find the highest Australian mountains on the east coast, the Pacific again being larger than the Indian Ocean. In Tasmania, however, matters are somewhat different, for there is an unbroken stretch of water from its west coast to South America; while on its east coast, some twenty degrees distant, New Zealand acts as a breakwater, and braces up the ocean, so to speak, relieving the east coast of Tasmania of much pressure from the main body of water. Therefore we are not surprised to find that the backbone of Tasmania is on the western side, especially when we find a map in Wallace's "Island Life" showing the deep water on the west coast at 2,600 fathoms, against 2,000 fathoms on the east coast. We not only have the horizontal pressure of the ocean, but also the vertical pressure, and the force is not a steady one, but varies with the tides, this movement being more effective in shifting the earth's crust than a dead pressure. The pressure of the immense bodies of water in the oceans are working as hard to-day in the building up, and indirectly in the pulling down, of our mountain systems as they have in the past, and it makes its pressure felt second-hand by the enormous weight of the rocks that they pile up, which in their turn exert a vertical pressure. We generally find that the actual coastal range is not so high as the next inland one, as if the force causing the mountain system had limited the area on which the range nearest to it could draw; also that the ranges following the main one are lower and further away from each other as they go inland. So in the case of Tasmania we find the West Coast Range comparatively low. Then comes the Main Range, including the Frenchman's Cap, Eldon Range, and the Cradles, which are among the highest mountains of Tasmania. These are followed up further inland by the King William Range. These ranges are like immense fossil waves rolling inland. They have a long slope on their western side and a steep one on their eastern, just as if they had been pushed up by the sea. Having taken a flying survey of the physical features of Tasmania we will now make a few remarks relative to the mineral wealth of the West Coast, and more particularly to the Mount Lyell district.

GEOLOGY.

The West Coast of Tasmania is rich in the variety of its minerals, among which ores of the following metals are found:—Tin, gold, silver, lead, zinc, copper, iron, chromium, nickel, bismuth, wolfram, iridium, antimony, manganese, and mercury; also other minerals of commercial value—*e.g.*, marble, serpentine, asbestos, lignite, etc.

Mount Lyell (named after the celebrated geologist, Sir Charles Lyell)—and its district is a most interesting one from a geologist's point of view, for here we have two or three different types of ore deposits. The most widely known, perhaps, is that called the "Iron Blow," on account of the hugh boulders of hematite (specimen 556) outcropping on the surface. Mounts Lyell and Owen (named after Professor Owen) are two peaks of the West Coast Range, divided by the Linda Valley, but connected on their western slopes by a saddle, which forms a watershed, the drainage on the east flowing down the Linda into the King River, and that on the west finding its way into the Queen River. That portion of the Iron Blow worked by the Mount Lyell Gold Mining Company is situated on the eastern side of the Mount Owen end of the saddle. The country rock about here consists of sandstones, green—(specimen 546) and red (specimen 551), bleached at the surface (specimen 553); various schists—ferruginous (specimen 550), talcose (specimen 548), hydromica (specimen 547), etc.; and limestone (specimen 552), which has a schistose structure. The general strike of these rocks is approximately parallel with the West Coast Range, and also the sea coast in these parts. The older rocks are overlaid with a quartz conglomerate (specimen 549), which caps the highest points of Mounts Lyell and Owen.

The Iron Blow Deposit.—Mr. G. Thureau believes this lode to be due to thermal action, but after carefully going over the ground three or four times I failed to find any facts which would confirm this theory.

Some people are pleased to consider this a so-called "true fissure lode," but this fissure theory, which has been applied to the majority of lodes, is fast dying out, for, assuming a fissure to be formed for the sake of argument, any man accustomed to mining is aware that conditions which would enable the walls of that fissure to keep open until the intermediate space was filled up with mineral matter by means of water must be very rare indeed. If the country rock has simply been loosened by some dynamical agency, or even if a fault caused a fracture and displacement of the rock, any cavities due to irregularities of the walls would be filled up with rubbed off portions of the sides which have been loosened by the movement, thus packing the space between the walls like mullock in a worked-out lode. There is, then, no fissure, and the whole affair must be relegated to an exaggerated form of loosened country, the interstices of which are filled with metallic minerals brought in by solution, which cement together the brecciated and powdered rock, sometimes even replacing it. However, the Iron Blow shows no signs of this, but, on the contrary, gives every indication of belonging to that class of deposit known as segregation lodes.

The two prevailing tints that the sandstones and schists assume when not bleached are green and red. Some of the bands of rock appear to have concentrated more iron than others, at the expense of their neighbours, and at times we get very dark shades indeed; in fact, in places it is completely turned into hematite, which retains the same laminated structure that the original rock possessed. This transformation can be traced in its various stages until we come to what we may consider the adult or perfect state, as exhibited in the Iron Blow. This deposit has not been actually traced for any great length, but a similar class of stone has been found here and there on its course so far north as Mount Sedgwick, but whether these outcrops belong to the same layer of altered schist or to parallel ones will not interfere with any interpretation of their segretative character. Although the Iron Blow is composed for the most part of hematite, it is not on account of its iron that it is worked, but because it is found to be the matrix for gold. Besides hematite we also find a fair amount of baryta (specimen 558), but, curiously enough, very little quartz. The footwall is red sandstone, with quartz, and the hanging wall iron pyrites, which we will speak of later on. The general strike is nearly north and south, though locally both strike and underlay vary considerably, which is just what one would expect in a disturbed country like this. The hematite may be divided into two classes, according to its hardness, these occurring in alternate bands, the softer portion looking as if it had been loosened by friction.

We now come to a very important point. There has evidently been some great strain about here, as indicated by cracks in the sandstone and conglomerate filled with quartz, and in the limestone, occupied with calcite; also by the fact that the conglomerate found on the tops of the mountains only occur in broken patches on the saddle. I am inclined to think that as the peaks of Mounts Lyell and Owen were formed the land piled up at those points was robbed from what are now valleys, the dragged out appearance of the country leaving one under that impression. The great weight of these accumulations could not be without effect on the weakened neighbourhood, and when settling down it would have the same effect as if one were to catch hold of opposite ends of a pamphlet and press them towards each other, if I may be allowed to make use of a homely illustration. If this took place after most of the Iron Blow hematite was deposited it would account for some of it appearing to be rubbed up along the lines of least resistance, which are coincident with the planes of bedding and cleavage. It would also account for another deposit adjoining the Iron Blow, though entirely distinct from it. On the hanging wall of the hematite, as before mentioned, is a large deposit of iron pyrites (specimen 555). If we examine the structure of this we find that when undecomposed it is inclined to be schistose, and has a remarkably close, dense texture. The boundary between this pyrites and the hematite is very sharp, which is what we would expect if due to the cause I suggest; for if such a settling down of the mountains on each side took place after the hard hematite was segregated, there being little cohesion between the hematite and the softer schists, a rupture would most easily take place between them; and the hematite, not yielding so readily to pressure exerted end on to its grain, would break up into fine particles that could occupy any loosened portion of its body; while the country rock, being more flexible, would bend rather than break, and so remain porous until infilitrated mineral solutions filled up all the spaces. The country rock about the iron pyrites deposit occurs at various angles of strike, as if wrapping round it, and the talcose schist illustrates the lenticular nature I have tried to describe on a small scale. There are no signs of sudden rupture having taken place here, but everything points to a gradual motion, which in all probability is continued at the present day. Associated with the iron pyrites we find galena; also copper pyrites, with its resulting secondary minerals—viz., malachite, azurite, cuprite, and native copper. The pyrites deposit occupies a depression or gully running 25 degrees W. of N., the hollow evidently being formed by the decomposition of the pyrites, a large portion of it being dissolved out by water in the form of sulphate of iron, while that which is oxidised into gossan remains behind as a thin capping, until denuded by atmospheric agencies. I account for the pyrites being found so near the surface by the fact that the country here is very moist, a peaty water oozing out of the button grass, the reducing action of which would retard oxidation. I also credit this water with being the agent that reduces the silver and copper which we find in the neighbourhood. The water is so darkly coloured that one almost suspects Neptune of having upset his billy-can of tea. The mass of the pyrites is very poor in gold, but the gossan (specimen 559) or iron capping in places contains a fair amount. This is only reasonable, for a ton of gossan is greater in bulk than a ton of heavier pyrites, and since a ton of gossan must be the product of decomposition of much more than a ton of pyrites, the former will naturally contain the gold concentrated in it, unless washed away mechanically, but the vesicular nature of the gossan tends to prevent that, and the sulphate of iron formed would prevent it being carried away in solution chemically. The decomposed pyrites, when placed on litmus paper and moistened, shows a distinct acid reaction, and this stone, when passed through the battery, unless well leached first and washed with alkaline water, will eat into the plates and sicken the quicksilver.

The Linda Valley Alluvial.—Most of the creeks flowing into the Linda Valley are found to be gold-bearing, as is also the alluvial of the valley itself; in fact, it was by following up the auriferous debris to the foot of the Iron Blow that this now well-known deposit was discovered, and for this reason it is generally considered that the gold found in the low country was shed from the hematite. I have carefully examined some specimens found in the alluvial, which show gold clinging to its matrix. In some instances, it is true, we find the gold attached to hematite, but we also find it sticking out of quartz. However, specimens of either sort are rare, even at the head of the gullies, the gold being, as a rule, clean and in fine grains. Now, I believe that most of the gold and alluvial found in the Linda Valley—and for the matter of that, in the neighbouring creeks also—is derived from the conglomerate which caps the mountains hereabouts. My reasons are these:—

1. There is no earthly reason why gold should not occur in the conglomerate if it were formed from a gold-bearing country, and we know the West Coast to be auriferous in several places.
2. The alluvial at the head of the Linda Valley is water-worn, and composed for the most part of quartz pebbles. In such a position the quartz, if originating from close by, could not have travelled sufficiently far to be so rounded, besides, there is not much quartz in the neighbourhood, the rocks being mostly schists and sandstones.
3. The saddle at the head of the valley connecting Mounts Owen and Lyell has very little conglomerate left on it, though traces here and there can be seen that could not possibly have fallen down from the higher mountains. If the conglomerate originally on the saddle was ruptured and loosened by dynamical strains it would be the more easily disintegrated and washed down into the valley by sub-aerial agencies than the less disturbed and more solid rock on the mountains, which would account for our not finding much conglomerate left on the saddle; then, again, the pebbles composing the gravel of the alluvial in the valley are similar in size and nature to those found in the conglomerate.
4. Boulders of conglomerate can be seen in various stages of decomposition on the sides of the mountains and in the alluvial of the valley. I have washed the product from a decomposing boulder standing isolated on its way to a gully below, and have obtained a colour of gold. On making

enquiries from local miners, two of them—Jack Fehey and Steve Karlsen—informed me that they had also obtained gold from the conglomerate wash at different times.

5. That portion of the alluvial deposit which is composed of broken up schists is very poor in gold; that made up of red standstone drift is better, while that consisting of quartz pebbles is the best, and we seldom get a "duffer" dish from it. At Karlsen's face they average about five grains per lode, while at the Linda Valley claim they estimate four and two-eleventh grains per cubic yard of dirt.

The alluvial at the head of the Linda Valley is evidently not in its original position, as can be seen by the high angle at which it is found, for the gravel, sand, clay and lignite, all of which have different angles of rest, are tilted up to such a degree that proves they could not have been deposited in such a situation. Some people shirk the necessity of explaining the problem of the Linda Valley alluvial by saying that the whole mass has been turned topsy-turvy, but there are no signs of such a general mixing up: the tilting of the deposit from the original angle of deposition is all we require to make the whole affair clear, and such a movement in the earth's crust has evidently taken place here, as the bed rock is thrown out of its normal course. The richest portions of the alluvial is found to be the top and bottom gravels, and wherever certain small, heavy white pebbles, termed locally "Sailor Jacks," occur payable gold is sure to be found. At Delany's face they have obtained good results from the former, and at Karlsen's face first-rate gold has been won from the latter. Some persons suggest that the alluvial is simply conglomerate, which has slipped down bodily from the mountains; but this can hardly be the case, as the alluvial is quite loose, while the conglomerate is very compact; besides, the former is associated with lignite which we do not find on the heights above, thus proving that the gravel was deposited gradually where now found, and that the conditions then prevailing were favourable to a dense undergrowth. The presence of occasional patches of gravel in the lignite shows that the original organic mass grew in shallow places subject to floods, and it is only in such spots that we find gold in the lignite, this going to prove that the gold in the alluvial has been deposited mechanically, and not chemically, otherwise we would expect to find it richer near the lignite, which would tend to reduce it from solution, either by virtue of the organic substance itself, or else by the sulphuretted hydrogen given off by its decomposition. Drift wood may have contributed somewhat to these lignite deposits (specimen 561), but owing to their depth I consider most of the vegetation grew *in situ*; well preserved samples of King William pine (specimen 563), and leatherwood (?) (specimen 562), can in places be picked out, and sometimes the ligneous matter has collected iron pyrites about it (specimen 560). A little cement is now and again to be met with: this in all probability was caused by pyrites being formed, an opportunity being given to the iron present to obtain sulphur from the decomposing vegetable matter, and the more heavily charged water finding its way to the comparatively stagnant bottom would cement the pebbles together. In course of time, as the deposit was drained, this pyrites would become oxidised, as we find it at the present day in Karlsen's face. Many of the streams on the Mount Lyell side of the gully have been worked for gold, until the heavy conglomerate boulders have become too numerous to remove. Besides gold, native copper is also obtained.

Mount Lyell Copper Deposits.—On tracing the alluvial copper to its source we are led to a zone of decomposed schists, forming a pug—grey, yellow, and red—some hundred feet broad. Where cut by the creeks this zone would appear to be equally productive throughout, as the tenacious clay retains most of the copper that is shed on to it; but when we clean up the bed of the watercourses we find the copper is confined to three distinct deposits, which run parallel, from two feet wide downwards. Where the pug is comparatively dry, a little below the surface, it flakes off in pieces corresponding to the cleavage plains of the shale; while the copper is found in sheets, as if occupying the joints and cleavage plains of the original rock. These sheets of metal, which at times are fairly thick, get broken up into small nuggets, shots, and spangles, which are more or less coated with the black oxide of copper. Below the native copper we come across cuprite, which occurs in beautiful crystals, mostly octahedrons, with their edges truncated by faces of the rhombic dodecahedron. No doubt the native copper has been reduced from this by the agency of the peaty waters. Still deeper than the cuprite we come across copper pyrites, which takes upon itself the same form as the rock which it impregnates; in fact, it might be termed a cupriferous schist. Instead of copper pyrites the rock may be charged in a similar manner with iron pyrites, or both. When the latter takes place the copper pyrites is found concentrated on one side and the iron pyrites on the other, and when the deposit crops out at the surface the iron pyrites resolves itself into the oxide, which is sometimes accompanied with pyrolusite.

In presenting the above remarks to the members of the Royal Society of Tasmania I have carefully weighed the ideas and opinions of others who have visited the locality I refer to.

If the glasses through which I have viewed the works of nature will not allow me to agree with the interpretation that other observers have thought fit to make, I cannot be accused of having drawn on my imagination to obtrude a pet theory upon your notice, for I have endeavoured to give a correct description of matters as they at present are found, and to point out how, by using such forces of nature as are to be seen at work at the present day, such results could be brought about, not forgetting that time is an unlimited factor of nature's that enables her to produce results slowly, yet surely, in the world's laboratory, which man, during his short space of life, can never hope to attain by the same means.

DISCUSSION.

Mr. R. M. Johnston, F.L.S., in reply to Mr. Power, said:—Of the many hypotheses advanced at different times to account primarily for the oscillations of the earth's surface it is frankly acknowledged by those who espouse one or other of them that all are open to objections of some kind.

There are three hypotheses, however, ably supported by celebrated physicists, which severally seem to find greatest favour among geologists, some espousing the one and some the rival hypotheses. These three hypotheses are mutually exclusive, and may be briefly described as—

1. The contraction or cooling globe theory.
2. The gradation or surface displacement theory.
3. Mobility of a hypothetic fluid theory.

Undoubtedly the first of these has obtained the greater acceptance among geologists, owing mainly to the able advocacy of Robert Mallet; and although it is admitted that there are serious objections to its acceptance (notably those urged by Mellard Read in his "Origin of Mountain Ranges"), it is even now variously modified, the most widely accepted among geologists as furnishing an explanation of the origin of the upheavals and subsidences of the earth's crust. Such is the opinion of Dr. Geikie in his last great work.

The rival theories, though ably supported, have even greater objections urged against them, and even one of the most formidable opponents of the contraction theory in Australasia, Professor Hutton, cannot urge that it is disproved by the demonstration of the truth of any other hypothesis. In his able address before the A.A.A.S. he states that "During the last fifty years investigation has rather been destructive than constructive, but progress has been made. Formidable obstacles have been removed . . . No doubt the outlook is still foggy, but the horizon is clearing, and we may hope that when we have fuller knowledge of the movements of the crust we shall find a clear explanation of their cause." Until that time arrives we must be content provisionally with that hypothesis which seems to account most reasonably with the greater number of known facts. The proof of a more perfect theory has not yet been made evident.

Mr. Stephens, F.G.S., said that the author of the paper under consideration had evidently paid much attention to the geological formations of a portion of the Western Country, but, in dealing with the question of the history of the mountain systems and the general physical structure of Tasmania as a whole, he appeared to have relied too much on the information supplied by maps, which is necessarily very imperfect. That the chief agency at work in producing those undulations in the primary rocks which had brought into existence many of the mountain ranges and valleys of Tasmania might be traced to secular cooling and contraction of the earth's crust there could be little doubt, and the mountain systems of later date owed their origin indirectly to the same cause, though the valleys had, for the most part, been scored out by the ordinary processes of nature working on the surface of the country. In addition to what had been said in opposition to Mr. Power's water pressure and wave theory, it might be pointed out that until portions of the crust had been raised there was no deep sea, and therefore all that the weight of the water could do, if it had any effect at all, would be to moderate the downward pressure of neighbouring mountain ranges, which are always in a condition of continuous resistance to the forces which had elevated them. With reference to Mr. Power's remarks on the conglomerates of the West Coast, there could be no doubt that, as he suggests, some of the gold in the alluvial deposits has been derived from conglomerate formed from the waste of auriferous rocks. On the other hand it has to be borne in mind that, while there are many conglomerates interstratified with the primary rocks, and likely to contain gold in cases in which the cemented materials have been derived from auriferous veinstones, there are other conglomerates of more recent date which have been derived from bands of quartz rock, quartzite, and associated schists, such as occur in great force at Mount Arrowsmith, Rocky Cape, and elsewhere, in which no gold occurs to any appreciable extent.

Mr. A. Montgomery, M.A., Government Geologist of Tasmania, regretted the absence of Mr. Power, as he would have liked to have had from him further explanation of the new theories advanced. The subject matter of the paper had a very wide scope, comprising two new theories, one of the formation of mountain chains, and a second of the origin of lodes in general, and of the Mount Lyell lode in particular.

Each of these subjects was quite large enough to require a separate paper for its elucidation. Taking the new theory of mountain elevation first, the writer referred to Mr. Johnston's supposition that many of the Tasmanian mountains are due to the shrinkage of the earth's crust, and dismissed the whole contraction theory with the cursory remark that "it has long since been proved" that that explanation was insufficient. He thought that many other geologists would agree with him (Mr. Montgomery) in denying that any such thing had long since been proved. While it might be conceded that other agencies were at work, he did not think either that many would agree that the mere presence of the ocean was the greatest. The subject of the rate of the cooling of the earth and the contraction consequent thereon was a most abstruse one, and there had been great difference of opinion expressed about it. In his mention of the higher mountain ranges, the writer left out of account the great range of mountains extending from the west of Europe to the east of Asia, and right away from any large body of water. The theory enunciated was that the mere weight of huge bodies of water pressing on the crust of the earth forced up a part of the solid crust to a higher level, and he failed to see how such a thing could happen. Water could only raise water to its own level, and could not raise a heavier substance to a higher level. The theory brought forward to account for Mounts Lyell and Owen was a curious one, and he could not see the probability of it, unless indeed the change was ascribed to some grabbing influence from outside the earth altogether, that being the only sort of force that could rake up the material from the valleys and give the country a "dragged out appearance." This and the further reference to the effect of "the great weight of these accumulations" which are no sooner raised up than they begin to settle down again, presumably directly against the force that has just raised them, led one to think that the writer must have based his theory on the supposition that the whole crust of the earth was a jelly, and he suggested that this theory might be known as the Jelly Theory, to contrast it with those generally accepted. The "homely illustration" of the pamphlet was not a good one, as the forces there applied were two lateral ones in opposite directions, while that to be illustrated by it was one force acting vertically. The writer stated that the "fissure theory, which has been applied to the majority of lodes, is fast dying out;" but his impression was that 999 out of every 1000 geologists or men connected with mining would hold that theory as one that met the greater number of cases, and assert that true lodes were almost universally found to be fissure deposits. It was a fact that such packed spaces as alluded to by the writer as being sure to occur if lodes had once been fissures were common in lodes. The difficulties of imagining that a lode fissure could be kept more or less open disappeared when it was remembered that fissures were generally uneven, and that "faulting," even to a very slight extent, would result in a series of more or less connected but irregular cavities. That many lodes were lines of fault was well known. He instanced the case of the Tasmania reef at Beaconsfield, which crosses highly inclined and distinctly bedded strata almost at right angles. In the drive on the lode westward at No. 6 level a band of black rock is found on both sides of the drive for some distance from the shaft. On one side of the lode white sandstone then makes its appearance, but the black still continues on the other side, and it is not till a further distance of 104 feet has been passed over that the white sandstone comes in on it, thus proving a throw of the beds of the country rock of that amount.

Mr. R. M. Johnston expressed general approval with the criticism of Mr. Montgomery, and expressed regret that Mr. Power had not confined his attention to one of the many important subjects introduced and treated it in a more scientific manner.

Mr. W. F. Ward, A.R.S.M., Government Analyst of Tasmania, said:—Mr. Power, in his notes on the Mount Lyell district, takes exception to the supposition that "many of the Tasmanian mountains are due to the shrinkage of the earth's crust," although he admits that "some slight puckering of the surface may be due to this cause." In so doing he joins issue with the great majority of geologists; for, as Geikie, in summarising the causes of upheaval and depression, says:—"With modifications, the main cause of terrestrial movements is still sought in secular cooling" (and consequent contraction). Confining our attention to the Tasmanian mountains, we may say that the highest peaks are one mile in height, the diameter of the earth 8,000 miles; the whole of this cannot therefore be called more than a "slight puckering," and it would on a 2ft. globe be represented by the thickness of thin foreign note paper. As regards the alleged inadequacy of the shrinkage to produce this comparatively slight effect, Mallet, the great authority on this branch of the subject, estimates that the *diameter* of the earth when liquid was at least 189 miles more than it is now; this implies also a shrinkage of the circumference to the extent of nearly 600 miles, so that we seem to have a very ample margin, sufficient to account not only for Tasmania's comparatively small hills, but for such enormous rock masses as the Himalayas and the Andes. Not satisfied apparently with this, however, Mr. Power invokes other agencies for the formation of mountains, and says:—

1. "The presence of the ocean is the greatest of these."

2. "We have not only the horizontal pressure of the ocean, but also the vertical pressure, and the force varies with the tides, this movement being more effective in shifting the earth's crust than a direct pressure."

3. "These ranges are like immense fossil waves rolling inland. They have a long slope on their western side, and a steep one on their eastern, just as if they had been pushed up by the sea."

The nearest approach to Mr. Power's suggestions which I have been able to find, is that of some American geologists, viz.:—"That the removal of rock by denudation from one area, and its accumulation in another affects the equilibrium of the earth's crust, and causes subsidence where deposition takes place, while the denuded area being relieved of weight rises;" this, however, has been fully met by proof that "should the removal and deposit of a few thousand feet of rock so seriously affect the equilibrium of the crust as to cause it to rise and sink in proportion, it would evince such a mobility in the earth as could not fail to manifest itself in a far more powerful way under the influence of lunar and solar attraction." If, then, the pressure of a few thousand feet of rock be incapable of raising the level of neighbouring districts to any appreciable extent, still less can the pressure of water, which has only about one-third the specific gravity of rock, be capable of slowly raising land, and sending it rolling inland "like immense fossil waves." If such were the case still greater would be the mobility and the influence of lunar and solar attraction. With regard to the Iron Blow I have found some difficulty in following Mr. Power's theory; but in view of the close neighbourhood of the iron pyrites and the hematite, of the fact that each is schistose in structure, that each contains much barytes, and that the hematite is on the footwall of the vein or deposit, I am still of the opinion expressed some time back in reply to Mr. Thureau: that the Iron Blow itself is the result of the decomposition of some of this large deposit of iron pyrites. I will only allude to the question of "fissure" veins to point out that Mr. Power quotes no authority against and suggests no substitute for "this fissure theory," as he terms it. In conclusion I can only agree with Mr. Montgomery that Mr. Power, notwithstanding his disclaimer, *has* drawn on his imagination for his theories.

NOTES ON THE MOUNT LYELL DISTRICT, TASMANIA.

By Frederick Danvers Power, F.G.S.

In reply to my critics, I must say that I was rather surprised to find myself credited with being the author of new theories. It is possible that I am the first to apply the views expressed in my paper to Tasmanian geology, but I do not pretend to be the originator of what Mr. Stephens terms the "water pressure and wave theory," or of the anti-true-fissure-lode theory, although I am prepared to uphold them until disproved, or more suitable substitutes are brought forward. In writing my paper I took for granted that the researches of such men as Dr. W. B. Carpenter, F.R.S., and S. F. Emmons were known, and therefore considered it unnecessary to back up my opinions by quoting them and others, in the same way that it would be superfluous to quote Sir Isaac Newton when mentioning gravity.

My paper was intended to give but a sketch of the geology of the Mount Lyell district. To go into detail in the present state of the country would take months of residence on the spot. In making my views public I was aware from Tasmanian literature, as also by personal conversation, that they were in opposition to those generally accepted in the island, but by bringing the results of modern research to bear on local conditions, I had hoped to direct thought out of the groove into which it had fallen. Of course I did not expect to win those who had strong views on the subject over to my side at once, but I did expect them either to give valid arguments for their side of the question, or prove mine incorrect, especially when these sentiments are due to misconceptions on their part. Mr. R. M. Johnston, though expressing his strong opinion against my views, does not offer a single argument in favour of his, or against mine, unless his statement that most geologists have adopted the contraction theory to account for mountain formations can be considered one. In replying I am debarred from elaborating on my subject, as to give it full justice would require more time than can at present be spared. I must, therefore, be content with briefly vindicating my views. The two points on which we differ are :—

1. The main cause of mountain ranges.
2. The nature of most so-called true-fissure-lodes.

In the first place I do not consider that any one theory will account for all our mountain ranges. There are several labourers at work; but my contention is that the chief of these is the pressure of the ocean waters. The other agents are not ignored; due weight has been given to the contraction of the earth, rotation of our world, denudation, sedimentation, etc. Now, I do not for one moment suppose that as our earth cooled it possessed a smooth surface. Our knowledge of molten slags, both natural and artificial, tells us that there are several cooling centres, and these would at once set up currents, which, assisted by the evolution of gases, together with the lunar and solar attractions and the rotation of the earth, would form inequalities on the surface of the globe which served as the neuclei of our continents and oceans; the world would not then be universally covered with water, as I gather Mr. Stephens premises, for elementary elevations and depressions would be formed long before the earth was cool enough to allow water to condense on its surface. Our continental plateau once formed, and water made to occupy the basins, the pressure of that water immediately begins to act and increases as its quantity was augmented. At first, no doubt, the cooling of the crust would have a greater effect in raising land than the pressure of water. Volcanic action would also be a main feature, and the tendency of our rotating earth to throw bodies towards the east, which is made so obvious by our trains and steamboats at the present day, would have a greater effect on the cooling mass than on our more solid crust; but under the conditions then existing disintegration would be more rapid than at a later period, for the rocks would not be protected by vegetation to the extent that they were later on besides, violent storms, humid atmosphere, and the large quantity of carbonic acid in the air would soon work havoc among the hills, forming much sediment which would act on the comparatively thin crust in a somewhat similar manner to which the immense weight of the ocean does now.

Dr. W. B. Carpenter, C.B., F.R.S., in a paper read before the Royal Institution of Great Britain on 23rd January, 1880, entitled "Land and Sea considered in relation to Geological Time," says that the total volume of ocean water to that of land is as 36 to 1; that most land is in the northern hemisphere and most water in the southern; that the bed of the ocean is comparatively flat, not basin shaped; it descends suddenly from a comparatively shallow bottom to a very deep one; that we must distinguish between the real and ostensible borders of the ocean basin, an elevation of 100 fathoms would generally show the real continental platforms, and would join many islands to the mainland, while if the existing land was depressed to the same amount very extensive areas of what is now dry land would be overflowed by the sea; that the movements of elevation which have occurred from time to time in various parts of the land areas of the globe have been the result of forces acting in different directions—vertical and horizontal; that extensive platforms have been raised by the former, while the latter will throw it into plications of which the elevated portions will form mountain ranges. "Also, the largest mountain chains characterise the borders of the greatest oceans, showing that the lateral pressure from the direction of the oceans was approximately proportional to the extent of the oceanic basin."

Now, the reason I chose to illustrate my views by South American and Tasmanian mountains in preference to the Urals, as Mr. Montgomery would like, was because I preferred to write of places I have visited, and not depend on maps more than necessary. And here I would remark that during my several trips to Tasmania, which have extended north, south, east and west, I have been careful to note the general direction of the main ranges, often climbing to lofty summits in order to attain my ends. However, if Mr. Montgomery prefers to discuss the Urals I am willing, and would direct his attention to the immense tract of low-lying swampy ground forming the Siberian plain to the east of the Urals, and north of the Altai, Yablonoi, and Stannovoi Mountains; also to the inland seas (Caspian Sea and Sea of Aral) and the numerous lakes forming a chain all the way north to the Gulf of Obe. Does not all this remind us that this land has at some time been submerged by the ocean, and would not require much change in its level to be flooded again? We thus see that though the Ural mountains are now away inland, they were once a coastal range, as were the easterly and westerly mountains above mentioned, which also run parallel to their former sea coast.

Tides and currents also have their effect on mountain building, not only on account of the sedimentation which they assist, but also by their own mechanical force. Thus we find the currents of the Bay of Biscay strongest opposite the Pyrenees; where the currents impinge on the Californian coast we find the Sierra Nevada; large currents curl round on the Chilian coast, and there we have the Andes; while coming nearer home we have the main current sweeping along the east coast of Victoria, close to our Australian Alps. The enormous weight of water in our oceans—36 times the volume of land—also tends to press out any inequalities that form on its bottom, and drive them onward towards dry land, where they are relieved of their pressure. To take another homely illustration, as if one were to flatten out a portion of a sheet of paper which was bulged up in a confined place. In order to bring in a flippant remark about some "Jelly Theory," Mr. Montgomery goes out of his way to apply hydraulic data to solid matter! which proves that he does not understand the situation. A solid body like rock will, as we well know, yield to pressure to a certain extent, and while it is being bent up a considerable amount of friction is developed. If the active force is removed the raised land will not fall back into its original position, for although the weight of the accumulated rock may cause a slight sinking, still the weight is not sufficient to overcome the necessary friction that the greater force was able to do; not only this, but the rock when strained will give in places, so as to ease itself, thus obtaining a state of rest, although out of its original position. We therefore see that this is not a case of balancing a dead weight, but one of steady pressure, and that it is not necessary for the rock to be so mobile as to be affected to any great degree by solar or lunar influences, as Mr. Ward suggests. It is my aim to account for the plications which we see, and know to have taken place; not to prove the earth's crust mobile like a jelly, so that it can have its form changed *ad libitum* like a rubber ball. Assuming Mr. Mallet's calculation of the 600 miles excess of original circumference to be correct, it by no means follows that all this surplus land is heaped into mountains. There are other land surfaces to be accounted for besides these, but even if these 600 miles were heaped up into our present ranges, why should these almost invariably be near past or present sea coasts, and more or less parallel to them, unless the oceans had some great influence over their structure? Again, if due to contraction, it seems rather strange that some of our highest mountains should be built up of comparatively young rocks, which could not have been deposited when most of the earth's crumplings, due to contraction, were formed, *e.g.*, the Alps, in speaking of which Professor Archibald Geikie in his text book, p. 918, writes:—"It is strange to reflect that the enduring materials out of which so many of the mountains, cliffs, and pinnacles of the Alps have been formed are of no higher geological antiquity than the London clay and other soft Eocene deposits of the South of England." I have been accused of advocating new theories contrary to well-known principles. What I have really done is to make use of nature's laws to account for observed phenomena, and not to invoke miracles to my aid. These laws of nature are in force now, and can be seen at work any day. It is no use for us to try and ignore them, for they will exist whether we like it or not.

To return to our local subject. If the ocean has not been the chief cause of the range which includes Mounts Lyell and Owen, how do my opponents account for its parallelism to the sea coast, and its steep slopes away from the sea; and why have the mountains that dragged out appearance and broken surface? Will not the phenomena observed be accounted for equally as well, if not better, by the views I have expressed than by the simple contraction theory? The pressure of water on the bottom and sides of a vessel containing it is well known; the force of the tides and currents is also appreciated. The effect of the rotation of the earth tending to throw objects towards the east is felt by our express trains and ocean boats, as is also that of winds; the shape of waves of water or sand is familiar as having the steeper side away from the force producing them; where, then, is the absurdity of accrediting the ocean with being the greatest auxiliary to the contraction of the earth in mountain building? Mounts Lyell and Owen show no signs of having been caused by simple denudation; there is no indication of there ever having been sufficient water to cut out the Linda Valley. The conglomerate capping this range was deposited before the mountains were raised, and most of the gravel in the Linda Valley is due to the weathering of the conglomerate, which was cracked and broken as the peaks raised their heads at the expense of the surrounding neighbourhood, for an inclined surface has a greater superficial area than a horizontal one.

Concerning the so-called fissure lodes, I consider the term as generally used misapplied. In our text books we find the fissure theory upheld. My old professor at the Clausthal School of Mines, Herr Dr. Bergrath v. Groddeck, states in his work on Lagerstättenlehre, "Gänge sind ausgefüllte Spalten." V. Cotta in his book writes:—"Since, according to our definition, all true lodes are aggregates of mineral matter in fissures, fissures must necessarily have first been formed and then filled. Both operations may have been independent of each other, and even when this is probably not the case still the formation of the fissure was an entirely different operation from that of their being filled with mineral matter."

Without disparaging text books, from which we learn the A B C of sciences, we really get more information from original articles and discussions on the same by men who have made researches from all points of view. Thus Mr. S. F. Emmons, one of the ablest living authorities on ore deposits, states that:—"Many deposits formerly supposed to have been deposited in open cavities have really been formed by metasomatic interchange of ore with country rock, *e.g.*, lead ore in limestone formations, Leadville, U.S.A. Very many so-called fissure veins in crystalline rocks are formed by percolation water circulating along joints and shrinkage cracks, fault planes or zones of crushed rock, which have filled the interstitial spaces and replaced the materials of the adjoining country rocks to a greater or less extent by the materials they held in solution, but are not the filling of any considerable open cavities." Mr. Richard Pearce in 1869 noted that the gangue material of the veins of Cornwall was the more or less completely altered country rock, and not foreign material brought from a distance.

Now, rocks may be so strained that faults result, but it is seldom that these faults leave open cavities that warrant the term fissure; for what would otherwise be a fissure is occupied by broken rock at the time of their formation. They are, therefore, not "true fissure lodes," such as may be seen in process of formation at the Steamboat Springs in Western Nevada, but fault lodes pure and simple, which show a brecciated structure, flucan, partings, slickensides, etc., all indicative of motion, and that usually gradual and under great pressure.

My idea of the genesis of the "Iron Blow" was that the hematite was segregated first in a layer of schist favourable for it; that after the peaks of Mts. Lyell and Owen were elevated they sank slightly, when the saddle connecting them was strained; the hematite being hard and strong was enabled to resist this force better than the weaker rock to its west, which, being loosened, located the site for the pyrites deposit. There is nothing peculiar in both the hematite and pyrites containing baryta, since they both, in my opinion, obtained their mineral from the same source, but there is no trace of any intimate connection between these two deposits, as there is a sharp line at their junction, and where we do find the pyrites decomposed it is converted into a gossan or hydrated oxide of iron, not hematite. Although the hematite deposit was not easily ruptured when pressed end on, yet the lateral thrust from the direction of the coast caused strike faults in it, as indicated by the soft rubbed-up portions where one part has slid over another.

Before condemning this opinion in an offhand manner, one should carefully weigh the pros and cons, utilising such knowledge as is possessed to enable a fair judgment to be arrived at. It is not very scientific to rest content with hypotheses because they happen to be generally accepted; we should be active in searching out the truth, and by upsetting one theory we advance one step nearer our goal, so that by opening the above questions fresh points should be gained, either by ridding ourselves of unnecessary theories or by adding fresh facts to our stock of knowledge.

TOTAL ECLIPSE OF THE MOON, 24TH MAY, 1891.

OBSERVED AT LAUNCESTON; LAT. S. 41DEG. 26MIN. 01SEC.; LONG. E. 9HRS. 48MIN. 31SEC.

BY A. B. BIGGS.

The computed times for this eclipse (disregarding the penumbra) were:—

		hrs.	min.	
First contact with shadow	...	2	29·8	A.M
Beginning of total phase	...	3	38·2	„
End of „ „ ...	...	4	57·2	„
Last contact with shadow	...	6	5·6	„

(All local mean time.)

Unfortunately, although I had made arrangements for watching all through the duration of the eclipse, my hopes were doomed to disappointment in regard to a satisfactory view of the event. On turning out I found the whole sky overcast with clouds, the moon just peeping out now and then between the thick clouds, but always veiled more or less with haze. So transient were the views that it was some time before I could adjust the telescope to focus. Having missed the first contact with shadow, I hoped to get the beginning of total phase, but it was not until 4hrs. 0min., or 2½min. after totality had commenced, that I could get a view. There was at this time, however, a bright rim on the eastern edge of the moon, apparently scarcely obscured, the moon appearing through the thin clouds like the young crescent. Again at 4hrs. 40min., or 17½min. before the end of totality, the crescent showed itself through the haze, but shifted to the other or preceding edge. At no time during totality was the darkness at all comparable with that of a cloudy, moonless night. It was evident that even in the midst of the cone of the earth's shadow some considerable amount of the sun's light reached the moon's surface. This, of course, can only be accounted for by the refraction of the earth's atmosphere.

The moon sank out of view behind the hills with the penumbral shade conspicuous upon her western rim.

The principal points which I set out to observe, namely, the actual moments of contact, the progress of the edge of the shadow over known points of the moon's surface, the tint, the amount of darkening, etc., were almost wholly missed. No definite estimate could be made as to the tint, veiled as the moon's face was more or less all through, but no trace of coppery tint was observable, only a dark, slaty gray.

(I have since learned that in other localities favoured with a clear sky the coppery tint was conspicuous. I can only account for my missing it by its being disguised by the persistent haze.)

The following extract from *Knowledge* of 5th June, 1885, may be of some interest by way of comparison with the foregoing notes. After referring to my report of the almost total eclipse of the moon on 30th March preceding, as given in the *Launceston Examiner*, which is quoted, the editor remarks :—

"The points of interest to be noted are the opacity and slaty tint of the earth's shadow, utterly obliterating all detail on that part of the moon's surface which it covered, and the entire absence of that copper-colour which had become so familiar to observers as to be regarded by them as almost the normal hue of the earth's shadow. Now it is noteworthy that this red tint was conspicuous by its absence on the occasion of the eclipse of the moon on October 4 last, whence it would seem that the terrestrial atmospheric conditions then existing must still persist."

I was favoured by a clear sky on that occasion.

THE TRANSIT OF MERCURY, MAY 10, 1891.

OBSERVATIONS TAKEN AT PRIVATE OBSERVATORY, LAUNCESTON.

By A. B. Biggs.

The morning of the 10th set in with a dense fog, hiding the sun from view. However, a few minutes before the expected entrance of the planet upon the sun's face (which was set down as 9h. 42min. 15sec. local mean time), the fog partially broke, giving promise of a clear view of the transit, a promise which was by no means fulfilled. A haze again covered the sun just before the critical moment, but a careful watch was kept on that part of the sun's limb where the planet was to enter. At 9h. 43min. 56sec. a partial clearing allowed a decided notch to be seen on the sun's edge. Of course the actual contact must have taken place somewhat earlier. The internal contact, so far as could be judged, occurred at 9h. 45min. 58sec. At 9h. 51min. 17sec. the planet was estimated to be one diameter within the sun's limb. During this time a local cloud condensation was taking place which almost prevented further observation, allowing, however, an occasional glimpse between the clouds, but through a haze at best. The alternate partial brightening and overshadowing was exceedingly baffling, and as a consequence the programme which I had laid out was seriously interfered with, besides necessitating a frequent changing of the apparatus to suit the varying conditions. About noon I found the speculum so bedewed that I could not see my face in it, and I had to take it out and warm it at a neighbour's fire. I feared at first that the silver film was destroyed, as the moisture appeared to have got underneath it. However, after a careful warming it came all right, and I had no further trouble with it.

There was a clear, well-defined spot on the sun's southern hemisphere, not large, about half a minute in diameter as nearly as I could estimate, including penumbra. Between this and the planet I managed to get a few chance micrometer measures, during the intervals of comparative brightness. Whilst engaged in this a *bright spot* on the centre of the planet's disc caught my attention, apparently as if the sun were shining through a hole in the planet. A similar appearance has been noted by some observers of previous transits, but the thing seems so unaccountable and improbable that it has been attributed to optical illusion. However, I could have no doubt of its reality on this occasion. The following note is from Chambers's Astromony:—"The annulus round Mercury and the *White Spot* on Mercury during transits across the sun may now be regarded as regular concomitants of the phenomenon; but there is no agreement amongst astronomers as to the cause of these appearances. The *White Spot* has been regarded by some as indicative of volcanic action, but this seems mere fancy. Prof. Powell, with more show of reason, suggested that diffraction of light had something to do with the matter. . . . . Huggins rejects this theory. It might conceivably have its origin in the internal reflection of light in a Huygenian eye-piece." (I was using a Ramsden or *positive* eye-piece). Webbe, in his "Celestial Objects," says that it "arises probably from deception from the violent contrast and the fatigue of the eye. . . . No terrestrial analogy will explain a luminosity thus visible close to the splendour of the Sun, and it seems natural to refer it to the exhausted state of the retina" (The haze on this occasion precluded the operation both of "violent contrast and fatigue.") A possible explanation may, perhaps, be found in connection with the *atmosphere* of Mercury. The "annulus," which is usually seen around Mercury during transits, would seem to indicate the existence of an atmosphere of considerable extent. (I failed to see it on this occasion, though, I believe, so far as I can recollect, that I saw it during a former transit; but unfortunately I took no notes at that time. The haze, however, would sufficiently account for my not seeing it this time.) This body of atmosphere would act somewhat as a lens (or rather as a "spot lens") and would form a diffuse focus or image of the sun on this side the planet. We should not under ordinary circumstances see this image, because the rays would cross and pass by on each side of us, unless there were some sort of translucent *screen* on which to receive it. Such a screen might possibly consist of the meteoric matter which is supposed, or I may say is known to exist in interplanetary space, some of which reaches us in meteoric showers, and some probably mere planetary dust, occasioning the phenomenon known as the "Zodiacal Light." (Of course every particle of this would be moving in some regular orbit, in accordance with gravitation law.) This may be deemed a very fanciful theory, and possibly may excite ridicule from mature scientists; but slow progress will be made in scientific knowledge if it is to be impeded by such a fear. I have not overlooked the fact that the outer or upper stratum of Mercury's supposed atmosphere would be more rarefied and less refractive than the lower; in fact it would be unequally refractive throughout; but this, I think, would be rather in favour of the theory, inasmuch as it would lengthen the focus and bring it nearer to us.

The contacts were observed as follows:—

LAUNCESTON MEAN TIME, MAY 10.			AT INGRESS.
hrs.	min.	sec.	
9	46	56·3	Sun's limb notched. Actual contact earlier.
9	45	58	2nd or internal contact, apparent geometrical, but no appearance of solar light outside the planet.
9	47	52	In clear of sun's limb.
9	51	17	About 1 diameter clear of limb.
P.M.			AT EGRESS.
hrs.	min.	sec.	
2	31	38·25	About 1 diameter from sun's limb.
2	35	10·3	Apparent geometrical internal contact, slight ligature (?)
2	36	41·7	Apparently bisected.
2	38	40·7	Clear from sun's limb.

MICROMETER MEASURES

Between Mercury and Sun-spot.

(Mercury South. Preceding.)

Local Mean Time.			Edge of Mer.	Edge of Spot.	Difference Dec.		Mer. Pre.
hrs.	min.	sec.			′	″	sec.
0	49	8·4	N.	N.	7	27	—
0	54	38·5	N.	N.	7	40	5½
1	43	26	Centre	Centre	8	52·3	17
1	43	43	Pre.	Pre.	—		18½
1	53	20	Centre	Centre	—		19½
1	53	39·5	S.	N.	9	35·2	—
1	58	4	N.	Sun's S. limb.	1	14·6	—

The above were all the measures I had opportunity for obtaining. The chronometer readings are carefully corrected for error and rate. Mr. Sparrow, of Launceston, kindly assisted me by reading the chronometer.

OBSERVATIONS ON THE CAUSES OF ELEVATION AND SUBSIDENCE OF THE EARTH'S CRUST.

BY R. M. JOHNSTON, F.L.S.

Any enquiry into the causes which have produced, and are still producing, mountains and mountain chains cannot be satisfactorily carried out apart from the study of the causes which originally produced the grand irregularities of surface, which primarily determined the original areas of continents and oceans.

In offering any opinion of my own upon the merits or defects of the rival hypotheses assumed by so many eminent physicists to account for elevation and subsidence, I hope it will be conceded that I do so with much diffidence; for where so many eminent men fail to be satisfied with each other's views on a subject which necessarily rest so largely on arbitrary values for unknown data, it is obvious that any view which I may tend to favour must in my own mind be attended with a large measure of doubt, and on some obscure points my judgment may be suspended entirely. As a novel theory, however, has recently been referred to by Mr. F. Danvers-Power, relating to the elevation of mountain chains, it may be of some interest at this time to enter more fully into the consideration of those hypotheses of causation which have gained the most favour among physicists and geologists. Of course the correct observation of effects and the true interpretation of immediate or primary causes are very different things. The geologist, as such, is entitled to speak with authority as regards the former, but undoubtedly the correct interpretation of causation is more purely within that realm of science where the physicist, as such, has the greater claim to be heard. The geologist may best know what are the magnitude and characteristics of certain obvious changes in a given region, but his interpretation of the cause or causes at work—not so open to observation—may be liable to errors from which the knowledge of the physicist might have saved him. The apparent cause to the geologist may, to the mind of the skilled physicist, be altogether objectionable when tested by his more exact methods for determining its nature and efficiency. With some the mere parallelism of certain phenomenal features—great ocean boundaries and certain mountain chains—often appear to stand as cause and effect. This may be so; but is it true? The answer to this query will be given hereafter. As it is desirable before discussing any one view to summarise briefly the principal hypotheses which have gained the greatest acceptance among scientific observers generally. The evidences for the vast extent of movements of elevation and subsidence, past and present, are so well established that I need only confine my attention to the leading theories concerned in their causation.

FORMATION OF CONTINENTAL AREAS AND OCEAN BASINS.

Assuming that at first the earth was a heated sphere around which the existing waters of ocean seas and rivers were gathered in the form of a gaseous envelope, we are led to conclude that the radiation of heat, immediately prior to the cooling and consequent condensation of water vapours, would gradually tend to form a solid crust. The question of importance at this stage is: Was the surface matter homogeneous and smooth immediately before and after it hardened into a crust, or was it heterogeneous, containing irregularities of surface? If the former, we could not imagine how the condition for determining continental areas and oceanic basins could be initiated. We are therefore led to accept the alternative hypotheses as more in accord with known facts. But the root matter here contemplated involves the conclusion that prior to the cooling and condensation of the gaseous vapours, which eventually occupied the primæval ocean basins, the forces of themselves then at work were equal to the task of producing irregularities on the earth's surface, whether by contraction expansion, or transfer, sufficiently grand in scale to form more or less elevated continental areas in the midst of basins grand enough to receive the oceanic waters. There may not have been at this stage either deep abyssal regions on the one hand nor high mountain peaks on the other, but it is almost certain that forces then at work sufficed to produce such relative elevation and depression, as are now supposed by many to be only rendered possible by changes in the loaded surface caused by the transfer of superficial solid matter mainly through aqueous agencies. A diversified distribution of the surface magma is assumed with good reason by Mallet, J. D. Dana, Prof. Hennessy, Archdeacon Pratt, Geikie, and many other eminent physicists and geologists, as a primary condition; and this primary condition, owing to the unequal rates of cooling, and differences of density of different masses of magma, is assumed to be the initial factor in producing elevated and depressed surfaces. Dana in his last work ("Manual of Geology," 3rd edition, 1879) states:—"The fact that the continental and oceanic areas were determined in the first cooling of the globe signifies that in the cooling or the radiation of heat into space there were areas of greatest and least contraction. This difference in cooling and the resulting level of the surface must have been owing to some difference of quality or condition in the material." One quality has been brought to light by pendulum experiments in India, proving that gravity is greater at the coast stations than at the continental stations, and greater at the island stations than at the coast stations. In harmony with these observations are the opinions advanced by Archdeacon Pratt (The Figure of the Earth, 1860; on the Constitution of the Solid Crust of the Earth, *Nature*, 1871) who first attributed the origin of oceanic depressions and continents, and also of mountain chains, to unequal contraction in a cooling globe, but in the last refers the formation of mountains to lateral pressure, and there concludes "That the crust beneath the ocean is of greater density than the average portions of the surface—that is, where the contraction was greatest the density of the rich material below is greatest and proportionately so." Mr. George H. Darwin, in investigating the bodily tides of viscous spheroids (Phil. Trans., 1879), among other important matter also points out that under the combined influence of rotation and the moon's attraction the polar regions tend to outstrip the equator, and to acquire a consequent and slow screwing motion from east to west; and Dr. Geikie, who has certain objections to offer, admits in respect of Darwin's theory, that it is conceivable in earlier conditions of the planet, that this screwing motion may have had some influence in determining the surface features of the planet. In a body not perfectly homogeneous it might originate wrinkles at the surface running perpendicular to the direction of greatest pressure. "According to this theory the highest elevations should be equatorial, and should have a general north and south bend, while in the northern hemisphere the main direction of the masses of land should bend round towards the north-east, and in the opposite hemisphere towards the south-east." While there are many difficulties standing in the way of the full acceptance of Mr. Darwin's theory, Dr. Geikie still thinks "It is well worth consideration whether the cause suggested by Mr. Darwin may not have given their *initial trend* to the masses of land, *so that any subsequent wrinkling of the terrestrial surface due to any other cause would be apt to take place along the original lines.*" I might also add that to such influence in some measure might be still ascribed those remarkable lines of weakness in both hemispheres, which mark the course of volcanic action, and which, in a large measure, *may determine the curves of certain coastal mountain chains.* Apart, however, from the universality or antiquity of alleged causes advanced as the principal factors in mountain making (I here use the word mountain-making in preference to mountain-building, for the latter term is more appropriately restricted to peaks and cones built up by volcanic agency), it must be confessed that whatever mountain chains were formed in the earliest geological periods they have been largely obliterated in later times. This is becoming more evident as geological observation extends; for it is now well established that in Asia, South America, North America, and in Europe, the great era of mountain making was during the Tertiary period, and even in Australasia it is probable that its principal Alpine ranges were inconspicuous ridges during the early part of the Mesozoic period. Still the intensity and universality of the elevations then produced demand a corresponding universality of cause, or causes. A considerable number of hypotheses at different times have been proposed by eminent investigators, all of which commend themselves in some particulars, but all of which, taken separately, involve difficulties which at present appear to be insurmountable. Perhaps the truth lies in several, and, *at least*, does not demand the rejection of one cause because another seems to answer all the conditions when confined to a particular case. It appears to me, however, that there is one which may be well considered as the governing or mother cause to two or three of the rival hypothetical causes; the latter being consequents standing in the relation of child to parent rather than absolutely independent causes. The parent cause, in my opinion, appears to be the Contraction Theory so intimately associated latterly with the name of Robert Mallet.

CONTRACTION THEORY.

If our planet has been steadily losing heat by radiation into space a corresponding diminution in its volume must also be looked for; for cooling is implied in contraction. A succinct account of the effects which Mr. Robert Mallet demonstrated might be expected from the secular cooling of our globe is given as follows by Dr. Geikie:—"According to Mallet the diameter of the earth is less by 189 miles since the time when the planet was a mass of liquid. But the contraction has not manifested itself uniformly over the whole surface of the planet. The crust varies much in structure, in thermal resistance, and in the position of its isogeothermal lines. As the hotter nucleus contracts more rapidly by cooling than the cooled and hardened crust the latter must sink down by its own weight, and in so doing requires to accommodate itself to a continually diminishing diameter. The descent of the crust gives rise to enormous tangential pressures. The rocks are crushed, crumpled, and broken in many places. Subsidence must have been the general rule, but every subsidence would, doubtless, be accompanied with upheavals of a more limited kind. The direction of these upheaved tracts, whether determined, as Mr. Darwin suggests, by the effects of internal distortion or by some original features in the structure of the crust, would be apt to be linear. The lines, once taken as lines of weakness or relief from the immense strain, would probably be made use of again and again at successive paroxysms or more tranquil periods of contraction. Mr. Mallet has ingeniously connected these movements with the linear direction of mountain chains, volcanic vents, and earthquake shocks. If the initial trend to the land masses were given as hypothetically stated by Mr. Darwin we may conceive that after the outer parts of the globe had attained a considerable rigidity, and could then be only slightly influnced by internal distortion, the effects of continued secular action would be seen in the intermittent subsidence of oceanic basins already existing, and in the successive crumpling and elevation of the intervening stiffened ridges." To overcome the difficulties which arise out of one or other of these hypotheses various modifications of the contraction theory have been generally adopted, the greater number still adhering to the view that the *main cause* of terrestrial movements must be sought in secular contraction. The theory which seems to be most favoured next in importance to the Contraction Theory is:—

> The alleged expansion and contraction of the underlayers resulting from a rise or fall of temperature caused by the loading or unloading of the areas affected.

Great uncertainty still exists as regards the present condition of the earth's interior; some conceiving it to have a fluid or viscous central core; some again incline to the view that a viscous intermediate layer separates the solid crust from the solid nucleus; while others have given reasons for the view that on the whole it has now attained a rigidity equal to that of glass or steel.

EXPANSION AND CONTRACTION OF THE UNDERLAYERS RESULTING FROM A RISE OR FALL OF TEMPERATURE.

Babbage seems to have been the first to suggest this theory. In his memoir (1834) on the Temple of Serapis, "Besides recognising the relations of isothermal planes, and the effect upon them by the surface changes, whether removals of rock material, or accumulation, the memoir accounts for changes of level caused through the expansion or contraction caused by changes in the subterranean heat or in the position of these isogeothermal planes." Mr. Mellard Reade has lately, "Origin of Mountain Ranges," strongly insisted on this factor as an important if not the main factor in producing subsidence and elevation. Similar views have also been strongly advocated by some of the American geologists who have explored the western territories of America. These have pointed "in proof of its truth to evidence of continuous subsidence in tracts where there was prolonged deposition and of the uprise and curvature of originally horizontal strata over mountain ranges like the Uintah Mountains in Wyoming and Utah, which have for a long time been out of water." Dr. Geikie, in commenting upon this theory, admits that in so far as the internal structure of rocks may be modified by such progressive increase of temperature as would arise from superficial deposit, the cause of change must have a place in geological dynamics, but he cannot allow that the removal and deposit of a few thousand feet of rock should exert such an influence as to affect the equilibrium of the crust; for to admit this, "would evince such mobility in the earth as could not fail to manifest itself in a far more powerful way under lunar and solar attraction." He, however, goes on to say "that there has always been the closest relation between upheaval and denudation on the one hand and subsidence and deposition on the other, is undoubtedly true." But he adds the significant words that "denudation *has been one of the consequences* of upheaval, and deposition has only been kept up by continual subsidence." Certain questions bearing upon the permanence of continental areas and great oceanic basins are involved to a great extent in the views under discussion, and may have led to the adoption of restricted views as to fundamental laws of causation.

Prof. C. Loyd Morgan in a recent article on elevation and subsidence (Geol. Mag., July 1888) in criticising the views of Mr. Mellard Reade and others as regards the effects alleged to arise out of the transfer of sediments suggests other ways in which the loading and unloading of the earth's crust may indirectly bring about subsidence and elevation, and at the same time ingeniously advances reasons in favour of the existence of an underlying liquid or viscous substratum. Accordingly, without committing himself to the acceptance of the theory held by those who attribute subsidence to mere weight he suggests to the upholders of that theory that the added weight of the sediment above would entail on this hypothesis an added weight below—that is if we suppose that the solidified rock adheres to the lower surface of the crust region. In a region undergoing denudation, on the other hand, the lightening of the load would entail the melting of some of the solidified or crystallised magma, assuming with Mr. Mellard Reade and Mr. Davison, that owing to the cooling and contraction of the earth's crust there is at some depth beneath the surface a level of no stress, where there is neither lateral compression nor extension, though the rocks are subject to the vertical pressure of the overload. He then suggests that throughout the zone of maximum tension due to circumferential contraction the rocks may be rendered fluid by relief of pressure. Such melting, he adds, would be accompanied by expansion manifesting itself at the surface by an uplift. By the expansion of the melting underlayers tensile stress in the overlying strata would be called into play, and this would throw those strata into a state of tensile strain, thus giving origin to normal faults to the gradual gaping of mineral veins and dykes, into which the molten matter would be injected by the expansive force. Without denying, therefore, the influence of secular refrigeration, he suggests that we have on this hypothesis an efficient primary cause of volcanic eruptions. Commenting upon the differences of opinion as to the level of the stress he points out that according to Mr. Davison it lies five miles deep; according to Mr. Mellard Reade it is taken at one mile; while Mr. O. Fisher would reduce it to less than a mile; and accordingly Prof. Morgan urges caution as to the use of precise imposing mathematical calculations based upon arbitrarily selected data where it concerns problems "concerning which the most noteworthy feature is our profound ignorance."

MR. DANVERS-POWER'S REFERENCE TO THE SUPPOSED INFLUENCE OF THE PRESSURE OF OCEAN WATERS UPON THE FORMATION OF PARALLEL MOUNTAIN CHAINS.

In regard to this hypothesis I must confess that to me it seems to be a most extraordinary one. Mr. Danvers-Power does not give us the slightest indication to help us to conceive how, of all agencies that may be concerned in the dynamics of mountain making, "the presence of the ocean is the greatest." It is hardly necessary to remind us how great is the influence of water in the work of denudation, and in the redistribution of wasted rock sediments over lower levels of sea and land; but how the gravity or even surface movements of ocean waters extending over wide ocean areas can concentrate their force of gravity or pressure laterally by thrust upon the margins of continents is a nice puzzle to any physicist. Surely it must have occurred to Mr. Power that the vertical radii of a column of rock is from 2½ to 3.4 times the specific gravity of an equal column of water; that the radii of a continental area are much greater than the radii over the more depressed ocean areas, capped as they are with the light element water; that the pressure of a fluid upon any of its limiting surfaces is altogether independent of its quantity (known as the *hydrostatic paradox)*; that is—the total pressure of water, (still) against and perpendicular to any surface is equal to the weight of a uniform column of water, the area of whose cross-section parallel to its base is everywhere equal to the area of oceans and mountain chains, I have only to observe that such parallelism need not be interpreted as cause and effect. Although, if we assume original flexures on Darwin's theory, trending in the present direction of these chains it is certain that if the continental areas so sculptured were slowly submerged in the direction of the great ocean areas, that the basal contour lines of height would certainly form the barriers to the ocean basins, and these of necessity would produce the parallelism referred to—*i.e.*, the downward sinking of the land would better explain the parallelism observed than the reference to pressure from the direction of the ocean, whether from its bed or its superficial waters. I think, therefore, that good reasons have been given for rejecting the theory put forward by Mr Danvers-Power.

A NOTE ON THE ARITHMOMETER AS AN AID TO ACTUARIAL WORK.

By F. J. Jacobs, A.I.A.

The arithmometer is peculiarly adapted for working out the chief details of a classified valuation of a life assurance office. The process is a simple one, being merely a series of multiplications, and the work can be carried out very rapidly by an ordinary computer. The results worked out and set down by one computer can be checked and verified by a second computer using a different machine, while any errors in the original work may be investigated by a third worker, using a third machine. By this means complete accuracy is ensured, and the use of the different machines avoids any possibility of error should either of them happen to fall out of order and become liable to repeat its own mistakes.

Several able expositions of the uses of the arithmometer have been published, and amongst them may be cited papers by Major-General Hannyngton and Mr. Peter Gray in the 16th and 17th volumes respectively of the *Journal of the Institute of Actuaries*. At the beginning of his paper Mr. Gray remarks:—"It is usual to describe the arithmometer as a machine which enables a person, however unskilled himself, to perform the operations of multiplication and division with facility, rapidity, and unfailing accuracy. This, as a description, is correct as far as it goes, but as an enumeration of the properties of the machine it is inadequate and defective. It entirely omits that property which forms its special adaptation to our purpose, and in default of which its utility would be comparatively limited. Besides the facilitation of the operations named the machine will also in forming the product of two given numbers either add that product to or subtract it from another given number according to the pleasure of the operator." Mr. Gray then proceeds to give illustrations of the adaptability of the machine for the construction of tables, and amongst the acturial problems he investigates are:—

1. To form a table of assurances from a corresponding table of annuities.
2. To construct a table of policy values from a given table of annuities.
3. To construct commutation columns from any given mortality table.

Amongst modern tables constructed by the calculating machine must be mentioned those computed by Mr. David Carment, F.I.A. A copy of the work is submitted for inspection. These tables show the value at the end of any number of years of an endowment assurance for £100, payable at different ages and under different rates of interest, according to the "Institute of Actuaries H.M. Tables of Mortality." In constructing these tables Mr. Carment utilised a modification of Gray's continuous method, and, speaking briefly, the work consisted in placing upon the machine a constant (the reciprocal of a certain function) and multiplying this by the successive differences of another function, the results being, of course, taken down after each operation. The process of the work is lucidly explained by Mr. Carment in the preface to his tables. It must be noted that the multiplication referred to is performed continuously, and that each step is performed *without* erasing the result attained by the preceding operation. The correctness of each column of results is proved by a very simple calculation. The whole of the tables were calculated by means of the arithmometer, with the exception of a small portion at the end, which. owing to the partial breakdown of the author's machine, were done by another process; the book is an interesting example of the work that can be performed by the calculating machine.

I have frequently had occasion to use the arithmometer in the computation of different results, and have found it a most correct and expeditious means of performing work that might, under ordinary circumstances require a tedious mental application. The arithmometer now exhibited by Mr. Johnston is, as he has stated, of the latest pattern, and combines the original model with a stability and perfection of construction that should reduce to a minimum the possibility of errors arising from imperfect or impaired machinery.

HYPNOTISM AND ALLIED PHENOMENA.

By Walter Spencer, M.D., M.R.C.S., Etc.

In judging newly observed phenomena for the purpose of reconnoitering the field for further exploration it is not easy to steer a medium course between the caution which demands too much and the receptivity which is satisfied with too little investigation. The former borders upon obstructiveness, the latter merges into credulity. In the first part of this paper I shall state ascertained facts, after which I shall have to lay bare the dilemma between necessary caution and regrettable credulity.

In 1843 Dr. James Braid, of Manchester, found that he was able in certain patients to induce an artificial sleep, accompanied by insensibility to pain. He made use of the power more for the relief of pre-existing pain than as a help in surgery, but under his auspices the eminent dentist, Sir J. Tomes, was surprised to find that he could extract several teeth without his patients having any consciousness of the operation. Dr. Braid used to rivet the attention and eyes of the patient upon something shining placed close at hand so that it was a strain to look at. He considered that fatigue of the ocular muscles was a chief factor in inducing the required condition. The new process was christened Braidism, but was not adopted to any extent in England, the triumph of the easy anæsthetics, chloroform and ether, seeming to render its practice unnecessary. In France, however, two great schools devoted to the subject (which Braid called hypnotism) have conducted interesting experiments for many years, under Professor Charcot, at the Salpêtrière, Paris, and Profesor Liébault at Nancy, the latter becoming known to fame as the originator of "hypnotic suggestion." Charcot is one of our foremost authorities on the management of hysteria, and has pursued the enquiry into hypnotism chiefly with reference to that abnormality of nerve function. We shall see, however, that the popular impression as to hysterical subjects being most predisposed to hypnotic influences is by no means proved.

At a general meeting of the British Medical Association held in August, 1889, a special section was devoted to hypnotism. It resulted in the expression of divergent opinions, in which, broadly speaking, French physicians maintained the affirmative and English physicians the negative view of the value of the study. Amongst the speakers was Dr. Voisin, of the Salpêtrière, who stated that he had by this means cured persons suffering from hallucinations and from sensory disturbances. Suicidal ideas and mania had disappeared under the use of the method. He had succeeded in curing dipsomania and morphinomania, as well as obstinate cases of juvenile depravity. Some of his patients had been put to sleep for from six to eight days. He had been able to transform his patients' habits of thought, and had brought them to love the good, whereas they before had only loved the evil. Dr. Yellowlees expressed amazement at these assertions, and remained incredulous, but Dr. Tuckey confirmed them from his experience of the practice of Dr. Liébault, who had successfully treated dipsomania and neuralgia. He cited the institution at Croydon, conducted by the Rev. Arthur Tooth, for the treatment of inebriates, where hypnotism was employed with much success, but he had been disappointed in the results of its application to the cure of melancholia, only 6 per cent. of the patients having proved susceptible. In the majority of cases it was not true that a patient after hynotism remained a mere tool in the hands of the operator. Dr. Ireland remarked that Braid had made claims as startling as those of Dr. Voisin. In one instance which he had published a flow of milk had been brought into one breast of a woman, while the other remained flaccid. Dr. Robertson said he had visited the Salpêtrière Asylum, and could corroborate Dr. Voisin. Dr. Percy Smith, of Bethlem Hospital, concurred with Dr. Yellowlees. He had made trial of the method with the assistance of a professional hypnotiser, and the results had been almost entirely negative; in fact, he had not been able to get insane patients into the hypnotic state. It seemed impossible to secure the necessary attention. This view of the question was confirmed by Dr. Goodall and others. Dr. Turnbull Smith asserted that in his experience nineteen patients out of every twenty had proved to be susceptible, but in some cases only after repeated attempts. Exhaustion of the optic nerve by means of staring had been found most efficacious.

This divergence of opinion extends to the methods recommended. Dr. Forel, of Zurich, states that he had noticed very ill-effects from using what he terms "the old bad method of fixation of vision."

Last year the attention of the medical profession in England was aroused by the report of a meeting held at Leeds, on March 28, of some sixty medical men and dentists assembled, at the invitation of Messrs. Carter Brothers, to witness a series of operations under the hypnotic influence of Dr. Milne Bramwell.

The first case was hypnotised at a word, and three teeth extracted without the operation having been felt.

The next case was that of a servant girl, M. A. W., aged 19, on whom, under the hypnotic influence induced by Dr.

Bramwell, Mr. Hewetson had a fortnight previously opened and scraped freely, without knowledge or pain, a large lachrymal abscess, extending into the cheek. Furthermore, the dressing had been daily performed and the cavity freely syringed under hypnotic anæsthesia, the "healing suggestions" being daily given to the patient, to which Dr. Bramwell in a great measure attributes the very rapid healing. She was pu. to sleep by the following letter from Dr. Bramwell, addressed to Mr. Turner:—

> "Burlington Crescent, Goole, Yorks. Dear Mr. Turner,—I send you a patient with enclosed order. When you give it to her she will fall asleep at once and obey your commands.—J. Milne Bramwell.
>
> "Order.—Go to sleep at once, by order of Dr. Bramwell, and obey Mr. Turner's commands.—J. Milne Bramwell."

This experiment answered perfectly. Sleep was induced at once by reading the note, and was so profound that, at the end of a lengthy operation, in which sixteen stumps were removed, she awoke smiling, and insisted that she had felt no pain, and, what was remarkable, there was no pain in her mouth. She was found after some time, when unobserved, reading the *Graphic* in the waiting-room as if nothing had happened. During the whole time she did everything which Mr. Turner suggested, but it was observed that there was a diminished flow of saliva and that the corneal reflexes were absent, the breathing more noisy than ordinarily, and the pulse slower.

Dr. Bramwell took occasion to explain that the next case, a boy aged 8, was a severe test, and would probably not succeed, partly because the patient was so young, and chiefly because he had not attempted to produce hypnotic anæsthesia earlier than two days before. He also explained that patients require training in this form of anæsthesia, the time of training, or preparation, varying with each individual. However, he was so far hypnotised that he allowed Mr. Mayo Robson to operate on the great toe, removing a bony growth and part of the first phalanx, with the result that he appeared to know very little of what had been done.

It was necessary in this case for Dr. Bramwell to repeat the hypnotic suggestions. Dr. Bramwell remarked that he wished to show a case that was less likely to be perfectly successful than the others, so as to enable those present to see the difficult as well as the apparently easy straightforward cases; "in fact," as he said, "to show his work in the rough."

The next case was a girl of 15, highly sensitive, requiring the removal of enlarged tonsils. At the request of Dr. Bramwell Mr. Hewetson was enabled in the hypnotic state to extract each tonsil with ease, the girl, by suggestion of the hypnotiser, obeying every request of the operator, though in a state of perfect anæsthesia. In the same way Mr. Hewetson removed a cyst of the size of a horse bean from the side of the nose of a young woman who was perfectly anæsthetised and breathing deeply, and who, on coming round by order, protested "that the operation had not been commenced."

Mr. Turner then extracted two teeth from a man with equal success, after which Dr. Bramwell explained how his patients had been completely cured of drunkenness by hypnotic suggestion. To prove this to those present, and to show the interesting psychological results, the man was hypnotised, and in that state he was shown a glass of water; he was told by Dr. Bramwell that it was "bad beer." He was then told to awake, and the glass of water offered him by Dr. Bramwell. He put it to his lips, and at once spat out the "offensive liquid."

Mr. T. S. Carter next extracted a very difficult impacted stump from a railway navvy as successfully as the previous case. Dr. Bramwell described how this man had been completely cured of very obstinate facial neuralgia by hypnotism, which had been produced by working in a wet cutting. On the third day of hypnotism the neuralgia had entirely disappeared (now some weeks ago) and had not returned. The man had obtained refreshing hypnotic sleep at nights, being put to sleep by his daughter through a note from Dr. Bramwell or by a telegram, both methods succeeding perfectly.

The facts as recorded may be taken as establishing the existence of hypnotism and of hypnotic suggestion. The divergent opinions of practitioners are, however, very hard to reconcile.

Dr. Moll denies that any hysteria or weakness of any kind in the physique of a patient leads to his being more readily hypnotised. Professor Wetterstrand says it depends more on character than temperament, and that the most impressionable ages are from 3 to 15, fit subjects after the age of 30 being rare. Dr. Sherman Bigg maintains that no man of average capacity can be hypnotised against his will, and that even when hypnotised he can restrict the hypnotiser's influence. Professor Bernheim believes that the suggested effects exist only in the idea of the patient; that if it is suggested that he cannot see a certain object he continues to see it, but imagines he does not, and acts accordingly. He is of opinion that the number of persons who can be readily influenced is very limited, and yet at a demonstration given in Paris he elicited confessions of imaginary crimes, weeping, laughter, dumbness and powerlessness at will from persons who had not been previously hypnotised, and who, to all appearance, were in full possession of their senses, playing on their nervous system as upon an instrument.

At a meeting of the Medical Institute of Liverpool Dr. Grossmann reported he had seen Dr. Bernheim hypnotise one patient after another in his hospital wards until not one remained awake; also that a blister was produced by the application of a postage stamp, which, it was suggested, would act as a vesicant.

Dr. Liébault asserts that concentration of a patient's mind on the idea of sleep will induce sleep by leading to forgetfulness of the outer world and to a state in which suggestions are readily adopted and acted on, the hypnotic differing from the ordinary sleep in that there exists a relation between the sleeper and the operator. Dr. Forel considers that hypnotism is a state of sleep artificially induced, during which the course of the patient's dreams can be influenced. It depends, firstly, on the power of falling asleep easily; and, secondly, on willingness to submit to the operator's will, the disappearance of nervous symptoms being explained in the same way as the sudden cessation of toothache or sciatica after a shock. He could induce sleep readily in fifty patients out of seventy-two.

The school of Nancy teaches that the lethargic, cataleptic, and somnambulic stages of hypnotism can be produced at any time by the suggestion of the operator, suggestion being the key to all the phenomena. The psycological stages of hypnotism, although they may be divided into three—lethargy, catalepsy, and somnambulism—are variously classified by different observers.

According to Wetterstrand they reveal:—

1. Sleepiness and sense of weight.
2. Inability to move a muscle.
3. Unconscious automatic movements.
4. Consciousness only of the operator and obedience to his will.
5. Somnambulism and complete insensibility.

According to Haidenheim:—

1. Imitative movements.
2. Exaltation of special senses.
3. Illusions and hallucinations.
4. Loss of pain and of sensation.
5. Tonic spasms.
6. Spasms of the ocular muscles, dilatation of the pupils, accelerated pulse and respiration.

According to Liébault:—

1. Torpor of limbs and somnolence, the will power being still available if needed.
2. Retention by the limbs of any strained posture, the patient still remaining conscious.

3. Perception of the operator only.
4. Advanced automatism.
5. Oblivion.
6. Submission to the operator's suggestions.
7. Susceptibility to post-hypnotic influence.

The methods of operators vary. Some employ slow passes made at a short distance, some stroking, some ocular fixation, some orbital compression, some any weak, continuous, and prolonged stimulation of the nerves of sight, touch, or hearing, some verbal suggestion alone. Haidenheim invites the patient to sit down, tells him that sleep will cure him, urges him to concentrate his mind entirely on sleep, looking at him very keenly all the while; tells him he will feel weight in his eyeballs and limbs, and gradually be unable to move. And when sleep has been induced the desired instructions are suggested to him.

Liébault begins by reassuring the patient, telling him to banish all fear and extraneous thoughts, to concentrate his mind upon following the operator's words and suggestions. He then suggests the stages of sleep one by one as follow:— Your eyelids are becoming heavy; you can hardly keep them open. My voice sounds more and more distant. Your sight grows dim; objects appear indistinct. Numbness is creeping over your limbs. You cannot keep awake; your eyes are shut. (Here he closes the patient's eyes.) You are fast asleep. He then rubs any affected parts, suggesting that pain is to pass away; that disturbed functions are to be restored to normal action, and so on, concluding with the suggestion that no hypnotiser's influence except his own shall be obeyed. He arouses the patient by a word or a few passes across the face. The foregoing cannot fail to remind us of the reported procedure of American faith healers.

Charcot induces the stage of lethargy either by compressing the eyelids or by causing the patient to gaze fixedly at a bright point; that of catalepsy by lifting the eyelids during the preceding stage or by a sudden flash or shock, and that of somnambulism by gently rubbing the top of the patient's head.

Variety of opinion and of practice is accompanied by variety of theory. Among theorists Mr. Julian Hawthorne regards hypnotism as akin to the mental exaltation of the poet and the orator. Dr. Regnier finds in it nothing of this sort, not even the ecstasy of the martyr or religious devotee. The practice is not devoid of danger. Dr. Julius Lolow records how an amateur at a friend's house volunteered to hypnotise another visitor, and after two trials succeeded so well that the subject became extremely excited, lost the power of speech, and then passed into the condition of catalepsy. Subsequently he had severe convulsions. He had been hypnotised by being made to look at a diamond ring, and afterwards the sight of anything glittering threw him into a state of violent excitement. The floor of the room in which the physician found him was covered with cushions, as he frequently threw himself from the sofa on to the floor. He performed various odd automatic movements, slept only in snatches, awaking in nightmare, and, in fact, was in a condition to which the French physicians would probably apply the term grave hysteria with maniacal excitement. He was treated with full doses of sedative drugs, but did not at first show any signs of amendment. After ten days the convulsive attacks were replaced by periods during which he sang persistently. He would sing over song after song, apparently every song he knew, and as long as one song remained unsung nothing would stop him. After about a fortnight of this sort of thing he had an attack of fever, followed by copious perspiration and asthma. A few days later he had another feverish attack, again followed by perspiration, after which he declared himself quite well. From first to last he was seriously ill for three weeks. The cause of the fever is not very clear. His physician believed it was probably due to inflammation of the anterior part of the brain. Instances similar to this have not been infrequent. It has therefore been resolved by the committee of the British Medical Association that public exhibitions of hypnotism are dangerous, and should be prohibited, a prohibition which has already become law in Belgium, France, Russia, and Portugal, the only result to State medicine of the study of hypnotism thus far.

I have hitherto been dealing with facts which appear to obtain general acceptance. Allegations are made as to further phenomena which require a good deal more patience in investigation. The power of raising a blister by means of an inert postage stamp or of causing a patient to obey commands given by letter shortly after leaving the hypnotiser is transcended by the alleged power to compel obedience after a considerable lapse of time. Induction of a condition of double consciousness, alternation of two separate mental states, lasting each for considerable periods, in which two different personalities, unconscious of each other, are revealed, is more extraordinary still, while the marvels of somnambulism, the display of faculties independent of the senses, reading with bandaged eyes, and description of simultaneous remote occurrences rival old legends of possession.

It will be useful to give you a brief sketch of the observations which preceded hypnotism. When we remember that this is not a new science, but only a new name, and that it is the habit of mankind to re-christen and adopt to-day many things which it rejected and reprobated yesterday, it should make us tolerant of other allegations the truth of which is not yet established.

About 1670 a gentleman named Valentine Greatrex, the "stroker" who had acquired repute as a healer of disease by what was probably a combination of hypnotism and massage, was actually commissioned by King Charles II. to exercise his skill during the prevalence of certain epidemic diseases. In 1772 Anthony Mesmer, M.D., of Berlin, began to investigate the influence of magnetism, and is said to have effected many cures. On propounding his theory of animal magnetism he provoked a storm of envy and malice which overwhelmed him, many of his patients, even after their transports of gratitude had cooled, being so swayed by popular prejudice as to aver that their cures must have been effected by chance. He was ejected from Germany, and no University deigned to give his claims fair trial, though they have come down to us under his name as "Mesmerism."

Surgeons of reputation, Recamier in 1829, Cloquet, and others, made occasional use of the method. In 1837 Dr. Elliotson established in London a Mesmeric Hospital, where he performed serious operations painlessly, but as he persisted in proclaiming the superinduced phenomena of "clairvoyance," transposition of the senses, etc., etc., he evoked a storm of contumely which upset the balance of his mind, and led to the termination of his existence by his own hand.

At about the same time that Braid began his experiments Dr. Esdaile, in India, in ignorance of those experiments, and under very different conditions, arrived at similar results. After five years' practice he left a record in Calcutta of 261 painless operations of severe character. This direct continuation of the practice, from Mesmer down to Charcot and Liébault, ought to influence our tardy recognition of the source to which honour is due.

A view prevails among the modern differing from that of the ancient professors of hypnotism. The former generally consider the phenomena to be wholly subjective, whereas the latter tended to the belief that they were objective. It is noticeable, however, that the former are not ignorant of the passage of some influence from the operator to the subject, Liébault admitting that "there exists a relation" between them, and Haidenheim when hypnotising looking at the patient "very keenly."

The belief that there is some emanation from the operator resolves itself, in my mind, into a recognition of the telepathic force of will power; that there is a transference of ideas from brain to brain. This transfer of force seems, like the zymotic diseases, to require an incubation period, which incubation period in this instance is characterised by somnolence or lethargy.

The British Medical Association recognises that hypnotism cannot be considered a general remedy of reliable action, and lays down the rule that a stranger should never be hypnotised without a suitable witness. No satisfactory explanation having yet been given, I am justified in assuming that the medical profession has now got hold of something which we do not understand. My mind was a *tabula rasa* as regards this subject, when, fifteen years ago, finding myself possessed of means and leisure, I undertook to study hypnotism and allied phenomena. Attracted by an advertisement, I made acquaintance with an illiterate man named Ashton, proprietor of a sort of hospital for magnetic healing, and took from him a series of lessons in his art. He was able to alleviate pain and disease chiefly of joints, displaying diligent patience and manipulative skill. I was impressed that a force emanated from him. On one occasion when he was declaiming in front of me at some 6 feet distance the rise and fall of his arms (he was a vehement gesticulator) when directed towards me so affected my nerves that I had to ask him to desist. After twelve lessons I found that I could generally relieve slight neuralgias of my friends and family. My opportunities were few. I could not go about gathering patients. The faculty I had acquired became enfeebled and left me through want of use, in accordance with Ashton's doctrine that it could be acquired and cultivated only by constant practice in most instances. After this I went through the whole round of spiritualism that was accessible to me, finding it wholly unprofitable to the mind, until I obtained an introduction to a well-known old gentleman, a Mr. Frederick Hockley, a man of erudition, but apparently of great credulity. His claims to a knowledge and practice of the occult sciences, made to me in confidence, simply, modestly, and as a matter of course, were little less than those of the mediæval magicians. Thirst for knowledge led to my becoming his most intimate friend, to whom he bared his heart, his history, and his lore. I cannot too highly estimate his goodness and nobility of mind. A bibliophite and bookhunter, he possessed an extensive and very valuable library of books and MSS. (now in the British Museum by his bequest), but the series of his own minutely-kept diaries, ranged in handsome bindings on his shelves, inspired me with more interest than all. He had long abandoned all other occult practice to devote himself to what we call "divination" by mirrors and crystals, consideration of which, I believe, will be found to throw a side light upon hypnotism. The notes of his numerous experiences, or, as he called them, "actions," bore by turns upon the most interesting metaphysical discussions, revelations on past, current, and in some instances future events, and scenes and anecdotes like those of an enthralling novel. The key to all the unexplained phenomena revealed by hypnotism and by all his studies is, he taught, to be found in concentration of will power by the operator.

Society has of late years been exercised in mind about thought transference and telepathy. We are familiar with drawing-room experiences of collective will power over one of a company who may thus be impelled to perform almost any incongruous act. I feel convinced that individual will power concentrated upon another by one who is able to use it, and under favourable conditions, must be reckoned remarkable, and in some cases irresistible. A sad case of the unintentional misuse of the influence is within my knowledge. About twenty years ago an officer in garrison at Malta found he thus was able to control the actions of a young member of the ancient nobility of that island, and was accustomed to amuse his brother officers at the expense of that gentleman. He carried it so far as to cause the victim to pick pockets. The officer returned to England, and some time afterward many small articles having been missed from the Club a detective was employed, who traced the thefts to the nobleman in question. The culprit was tried, found guilty, and sentenced, to the disgrace of his family and the ruin of his career.

Obedience by the subject in after days to suggestions given in the hypnotic state appears to be an extension of the influence which we are not able to explain. The supersensuous perceptions alleged to become manifest during the stage of somnambulism appear to be related to those recorded by Frederick Hockley from hypnotism by mirrors and crystals, and are equally unexplained. The evidence for this class of unexplained phenomena is becoming very strong, and rebuts dogmatism on the subject. Bearing in mind the slow stages of official recognition accorded to the simpler facts of hypnotism, we cannot be surprised at delay in the acceptance of its more advanced phenomena. These in former days always ruined the reputation of those who attested them.

A writer in the April number of the *Nineteenth Century* magazine, reviewing the claims of the advanced phenomena and urging them on the consideration of men of science, asserts "That it is possible for an experimenter to produce a hallucinatory image of himself in the perception of a friend at a distance without the friends having received any previous suggestion or anticipation that such an image would appear," and claims it as a fact "attested in several instances by trustworthy persons at each end of the chain." This claim, if it can be substantiated, may be found to correlate the admitted phenomena of hypnotism and telepathy with the astounding claims of the late Frederick Hockley.

Amongst instances where revelations received through his mirrors were confirmed by subsequent independent evidence is that which has been frequently quoted in spiritualistic literature of the minute description of a startling incident which occurred to the late Sir Richard Burton during his journey, in disguise, to Mecca, at a time when the world had given him up for lost. This vision, recorded in Hockley's diary simultaneously with the event, was verified and attested by Burton on his return. In the same diary stand recorded the ruin of the Tuileries and the attendant conflagrations in Paris years before the events of the Commune.

Amongst the array of extraordinary pretensions which the close of this century is reviewing we may detect much fraud, much collusion, imagination, and credulity, yet if anyone will devote three years, as I did, to their patient investigation, I say that he will be unable to deny the presence of some facts whose nature and relations to explained facts he will be unable to explain. And this is the attitude of the scientific world towards hypnotism.

ELECTRIC TRACTION.

By Montague Rhys Jones, C.E.

Whether the present generation has discovered the ultimate force in nature most applicable to the service of man is a question for the scientist of the future to answer. We can, however, claim this to be the electrical age, as in prehistoric times there were ages of stone and bronze, and in introducing the phenomenon of electricity, as applied to traction, we cannot help being forcibly reminded of the unity and continuity of nature, when we consider how the method of applying this unknown force has, like all other physical and social phenomena, "ever from simpler to more complex grown;" it now remains an important part of our environment and if we failed to correspond the result would be a retrograde movement of the human species.

Passing over its agency as a transmitter and reproducer of thought and sound, and other commercial and industrial functions, we come to its latest evolution in its application to the propulsion of railway and tramway cars. Its practical utility was first demonstrated at Berlin, in 1879, by Siemens and Halske, on an experimental line of 500 metres. The train consisted of a small electric locomotive and carriages, which had very small wheels, with two rows of seats running parallel with the rails. The locomotive was fitted up with one of Siemens' dynamo-electric machines, laid horizontally on a frame-work with wheels, the bobbin being parallel to the rails, and the field electric magnets perpendicular thereto. The rotary movement of the bobbin was transformed and transmitted to the driving wheels of the small locomotive by cog wheels, and a bevelled wheel completed the communication of the movement. A bar of iron, to introduce the current, was laid between the two rails, and encased in wood, to insulate it electrically from the soil; "two spring rubbers attached to the locomotive rested on the bar. The current was transmitted by these rubbers into the machine; after having done its work it passed through the wheels of the locomotive, and back to the generator by the iron rails. It was not necessary for the rails to be completely insulated, for if some of the current escaped into the earth, it still returned to the generator, that being equally connected with the ground."

The success of this experiment led to other attempts of an exhibitional nature, at Brussels, Durseldorf, Frankfort, and other places with the same result, and then electrical traction passed from the experimental to the commercial process of development, and the Lichterfelde Electric Tram near Berlin was the first of this kind. The length is one and a half miles, and the equipment in 1881 consisted of two motor cars, the motion being transmitted to the wheels by belts working on grooved pulleys outside the wheels. The prime source of power was a steam engine, with a Siemens' motör and generator; but the installation differed in some respects to the Berlin line, the central rail not being used, but the one rail acting as a lead, and the other as a return for the current. Up to 1887 this line carried a hundred thousand passengers yearly. These instances are merely recorded to show that the inception of Electrical Tramways took place in Europe, the principle being the generation of electricity by dynamo, and conveying the current through conductors connected by sliding contact with the cars while in motion. Modern electrical railways are now built chiefly on this principle, although America has far superseded Europe in the improvement and perfecting of the system.

After the year 1881 the commercial aspect of electric traction was carefully considered, and numerous lines were constructed both in Europe and America. In the former the mines of Zankeroid and Hohenzollern constructed short tramways the system of conductors, being overhead inverted T rails. They each carried 300 tons daily, at a cost of a halfpenny and three farthings respectively. The first electrical tramway in England was projected and constructed by Mr. Mangus Volk, at Brighton, in 1883. It runs along the sea beach for about one mile, and includes some heavy grades and sharp curves. The speed was limited to eight miles per hour, but twenty-five miles has been done. The current is transmitted along the rails, with a gas engine as prime power. One million passengers are carried yearly, at a cost of 1·92 pence per car mile, and nearly 50,000 miles are run during the year. In 1883 followed Port Rush, in Ireland, with a six mile length of single track, the current being sent along a third rail by water power. And here let me state that, in my opinion, both Hobart and Launceston are eminently suitable for electrical enterprise, and that a well digested scheme of electrical tramways could be devised for both places, as would compare favourably in point of economical working with any system in the world, owing to the existence of an abundant and permanent head of water, which could be utilised for the generation of electrical power, but a radical alteration would be necessary in respect to the permanent way which is now being laid down in Hobart. The rolling surface is of such a crude character as will not only seriously affect vehicular traffic, but the successful operation of electrical trams.

In rapid succession followed Blackpool with an underground system, technically known as the conduit system. Mordling, Frankfort-Offenbach, with overhead slotted tubes as conductors. Brussels and Hamburgh followed in 1886 and 1887 with the Juien system of storage batteries, which, as will be subsequently explained, proved a failure. So far as America is concerned she has left us far behind in the race for cheap transit.

The first electric railway in America was exhibted at the Chicago Exhibition, in 1883, by Messrs. Field and Edison, the track running round the gallery of the main building, curving sharp at both ends, with a radius of 566 feet. The total length was 1,500 feet. The gauge was three feet, with a central rail for the current, and the two outer rails for returns. On June 5th, the "Judge" and its car, loaded with sixteen passengers, was started. The railway ran for a fortnight, completing a mileage of 446, and carried 27,000 passengers. The trial was considered a success. Mr. Leo Daft then began experimenting with his electric locomotive, the "Ampere." The actual performance was the hauling of a railway car weighing ten tons with sixty-eight persons in addition to the motor, which weighed two tons and carried five persons. The speed was eight miles per hour, upon a track having a gradient of 93 feet to the mile, and included a 20 degree curve. A maximum duty of about 12 h.p. was registered; and, although the actual efficiency was not determined, the 25 h.p. engine which actuated the primary machine was also doing other work at the factory.

The first electric tram open for traffic in America was the Baltimore Union Passenger Railway, in 1885; it had two miles of single track, six cars, and 260,000 passengers were carried yearly up to 1887, at a cost of 16s. per car per day, each running 73 miles daily; a third rail was introduced as a conductor, also an overhead wire. Electrical progress in America since that date has been simply astounding. In the beginning of 1890, one hundred and fifty towns had electric trams, aggregating 1,670 miles of track, with 2,650 motor cars, equivalent to 70,000 h.p., running 150,000 miles per day, and carrying 200 millions of passengers yearly. The prime source of power required to meet this gigantic traffic is estimated at 40,000 h.p., and it is stated, on the authority of those competent to form an opinion, that 3,000 motors will be at work this year, carrying 3 millions of people, and calculated to return in fares about 3 millions sterling.

It is always a profoundly interesting thing to know something of the historical development of a force which is destined to greatly modify the physical and mental attributes of man, and if an apology be needed for entering so fully into the historical detail connected with the subject, that is my sole excuse.

Before proceeding to describe the methods of application, and so as to afford those who have not had an opportunity of studying the subject, it is proposed to briefly enter into an historical and physical description of the dynamo and motor, two of the most important agents in the application of electricity as a motive power, which will, it is hoped, enable them to have a thorough grasp of the principle.

Before explaining the physical theory of the dynamo, it may not be outside the scope of this paper to briefly refer to Faraday's discovery in 1831 of the laws of magnetic-electric induction. He found that induced currents could be started or stopped in an adjacent coil, which led to the further discovery that currents could be generated in a coil moved in the poles of a powerful steel magnet. He then made what he termed a "new electrical machine," whose parts consisted of a copper disc 12 diameter, and one-fifth of an inch in thickness, fixed on a brass axle, and mounted in frames so as to revolve, its edge being placed between the poles of a large compound permanent magnet. Copper and lead conducting strips were placed in contact with the edge of the disc, a wire from the galvanometer was connected to the collecting strip and the other to the brass axle. On revolving the disc a deflection of the galvanometer was obtained, which was reversed in direction when the direction of the rotation was reversed. Here, therefore, was demonstrated the production of a permanent current of electricity by ordinary magnets. From 1832 many inventions and improvements followed, until 1848, when Brett made the important suggestion of causing the current developed in the armature by the permanent magnetism of the field magnets to be transmitted through a coil of wire surrounding the magnet, so as to increase its action. This improvement marked an era in the evolution of the dynamo, being the first suggestion of the self-exciting dynamo. Then followed a period of great activity, when further improvements were effected, and in 1867 Dr. Werner Siemens described in the Berlin Academy a machine for generating electric currents by the application of mechanical power, the currents being induced in the coils of a rotating armature, by the action of electro-magnets, which were themselves excited by the currents so generated. To mark the importance of this departure, Siemens coined the word "dynamo-electric machine," which now is shortened into "dynamo," and which has now become the name for all these electric machines driven by mechanical power, whether self-excited or not. Brush introduced his famous dynamo of a shunt and series winding for the purpose of enabling the machine to do either a large or small amount of work. Many other Americans produced dynamos, amongst them being Edison. The dynamo was now brought up to a great state of perfection, and since the year 1883 the chief progress made has been in details of design and mechanical construction.

I will now proceed, as briefly as possible, to illustrate the physical theory of dynamo-electric machines, which I hope will enable us to understand more clearly the part they play in the propulsion of tramway cars. Professor Sylvanus Thompson defines a dynamo-electric machine as "a machine for converting energy in the form of mechanical power into energy in the form of electric currents, or *vice versa*, by the operation of setting conductors to rotate in a magnetic field, or by varying a magnetic field in the presence of conductors." Projected on the screen is a magnet with electric tufts from the North to South poles. (Plate I.) If iron filings were placed in these magnetic fields, they would arrange themselves thus:—(Plate II.) Now, if we place a conductor, such as a piece of copper wire, in this magnetic field, as it is technically called, and moved it about intercepting these lines, an amount of electricity would be generated in the conductor at right angles to the course of the movement of the conductor, and also at right angles to the direction of the lines of force. "This induced current is purely conditional on the intensity of the magnetic field, and the length and velocity of the moving conductors, as well as the resistance of the wire to the current." Now, as to what this current is, no one knows. It is one of those ultimate scientific facts at present behind the veil. Here is another diagram showing the magnetic field surrounding the conducting wire, end on. (Plate III.) Every wire, as Professor Thompson puts it, "is surrounded by a sort of magnetic whirl," thus:—(Plate IV.) To do this wants energy, and that constant, if to be maintained. It is these whirls which act on magnets, and cause them to set, as galvanometer needles do, at right angles to the conducting wire. It must, however, be remembered that a moving conductor in its motion must cut the lines of force that pass through the circuit of which the moving conductor forms part. I cannot illustrate this fundamental truth better than by throwing upon the screen a few diagrams of Professor Thompson's, and by quoting him on the subject:—"If a coil or wire circuit be moved along in a uniform magnetic field, as indicated in this diagram (Plate V.), so that only the same lines of force pass through it, no electric current will be generated; or if, again, as in this diagram (Plate VI.), the coil be moved by a motion of translation to another part of the uniform field, as many lines of force will be left behind as are gained in advancing from its first to its second position, and there will be no current generated in the coil; but if, as in this figure (Plate VII.), the coil be tilted in its motion across the uniform field, or rotated round any axis in its own plane, then the number of lines of force that traverse it will be altered and currents will be generated. These currents will flow round the ring coil in the positive sense. 'The positive sense of motion round a circle,' I may here add, 'is here taken as opposite to the sense in which the hands of a clock go round.' If the effect of the movement is to diminish the number of lines of force that cross the coil they will flow round in the opposite sense. If the effect is to increase the number of intercepted lines of force, if the field force be not a uniform one, then the effect of taking the coil by a simple motion of translation from the place where the lines are more dense to a place where they are less dense, as from position 1 to 2 on this diagram (Plate VIII.), will be to generate currents, or if the motion be to a place where the lines of force run in the reverse direction the effect will be the same, but even more powerful."

From the foregoing simple facts some very important consequences are apparent, the principal of which are these:—"Currents can be generated in conductors by setting up magnetic whirls round them. We can set up magnetic whirls in conductors by moving magnets near them or moving them near magnets. This means energy and an expenditure of power. The more rapid the motion the stronger the current, and by using a suitable commutator or guide all the currents, direct or inverse, produced during recession or approach can be turned into the same direction in the wire that goes to supply currents to the external circuit, thereby yielding an almost uniform current."

A very large number of dynamo-electric machines have been constructed on the foregoing principles, and the variety is legion, but the ones most used for the purpose of electric traction are those in which there is a rotation of a coil or coils in a uniform field of force, such rotation being effected (as in this diagram—repeat Diagram VII.) round an axis in the plane of the coil or one parallel to such an axis.

An electric motor is the reverse in its action to the dynamo, the latter converting mechanical energy into electrical force, and the former conversely transforms the current of electricity supplied by the dynamo from electrical force again into mechanical energy, thereby propelling the cars. The electric motor "includes all apparatus through whose employment work is performed." Everyone, no doubt, has heard of "Barlow's wheel." This was the first elementary electric motor. He found that by passing a current from the centre to the circumference of a copper disc between the poles of a magnet the disc would revolve. Faraday, you will have observed, in his researches in induction, reversed Barlow's experiment, but those discoveries resulted in the dynamo. It was not until 1873 that the reversibility of the dynamo was discovered, although for many years previous to this motors for driving machinery were operated, but depended on the galvanic battery for a supply of current. This process, being a very limited one, went to the wall when a cheaper current was effected by the discovery of the dynamo. The action of the practical and commercial motor now used is that of a magnet and a wire conveying a current, and is the reverse action of the dynamo, in which the motion of the conductor generates the current. On the other hand, a current in the conductor creates motion.

The law of the survival of the fittest has been an important factor in reference to types and varieties of the motor, not only in many mechanical appliances, but other resources resorted to to intensify the currents.

Having, it is hoped, given a clear insight into the theory of these electrical machines it is to be regretted that the limits of this paper will not permit a detailed description of the mechanical parts (Diagram of Sprague's Motor—A); but so long as the elementary truths have been retained, and that they will be brought to bear on the more descriptive portions of this paper, the object of the same will have been attained.

There are two methods of applying electricity for traction purposes—(1) by storage batteries; and (2) by metallic conductors over and under the track, known as the "overhead system" and the "underground" system respectively. These methods, however, are both of a direct nature, the motors being supplied with current from the conductors as wanted. As an ideal method of propulsion the storage or accumulator system stands pre-eminently foremost, and the best electrical intellects of the day are devising and improving with a view to eliminate the many defects which prevent it from being introduced commercially. The batteries occupy but little room, and are placed under the seats, and the motor is placed under the body of the car. There is no smoke or dust or accompanying noise and no street gearing, and the æsthetic sense is greatly conciliated by its attractive and graceful movement without contact. This is all very well on paper, but when brought into actual experience, like all ideals, it falls short of expectation. The serious objections to its commercial employment are that the accumulators are composed of lead, weighing altogether about 3,500 lbs. in an ordinary street car, thereby reducing the electrical efficiency by nearly 60 per cent. These cells, stored with power, have to be always carried about, whether over heavy or light grades, and if the car has to surmount any grade over 5 per cent., which is common in streets, the capacity and discharge rate is so limited that it is with only great difficulty and serious injury to the mechanical parts that they can be negotiated, and the chemical energy of the cells instead of supplying current developes heat and buckles the cell plates. Platinum or gold might withstand this constant molecular activity; but then, again, it does not do away with the dead weight, to say nothing of expense; but I believe gelatinous cells are spoken of as being highly probable in place of the lead cells. Last January I was asked to value the assets of the Eaglehawk Electrical Tramway Company, which was operated on the storage system for about three months or more, and which proved an entire failure. Its cost amounted to £40,000, and the debris was worth about £5,000. It could have been nothing but ignorance that suggested the storage system for Sandhurst, as the street conditions were entirely unfavourable for such. It is indeed difficult to speculate what the ultimate destiny of the storage car will be, but if improved up to present commercial requirements the most perfect ideal of street transit will have been accomplished.

The underground system, in point of construction, is very much like the cable system, so far as relates to the conduit for carrying the conductor, and the chief objections to it are cost of construction. The conduit in a busy thoroughfare would probably have to be excavated without the use of explosives, at a great cost; and without a large wetted perimeter is allowed for during heavy rains the channel would be flooded, and the water and street debris would come in contact with the conductor, which cannot be fully insulated owing to contact with the trailer, which is suspended from the car, and from which the motor takes its supply of current. The efficiency is entirely destroyed by short circuits and leakage. There are many other mechanical difficulties to be overcome, and one of the great drawbacks which militate against its success is the large amount of ironwork on the surface of the street, together with difficulties of switching and cost of maintenance.

We now come to that system which has been most successfully operated, commercially and practically, throughout the world, and whose adherents and supporters are growing yearly, namely, the "overhead system." Overhead conductors consist of two elements, one having a metallic circuit of two parallel wires, and the other only one overhead wire, the rails and earth forming the return current. There are various methods of contact between the car and the overhead wire, but the one universally used is the single wire under contact system, with bearing wires suspended crossways in narrow streets and centre pole suspension in wide streets, the chief points in favour of these arrangements being the neatness and simplicity of construction, the ease and perfection of all switching, and the well designed and permanent attachment of the trolly arm, a balanced and pivoted pole attached to the car rendering the danger of a falling trolly a very remote contingency. (Plate VIII.)

There are two prominent firms in America who by their great ability and energy have been instrumental in carrying out most of the electric roads in America. I refer to Sprague and Thomson-Houston. There is little in point of difference between the systems of either firm, but I shall describe Sprague's system as a type of this modern electrical railway, having been in communication with that firm in reference to the design of a plant for an electrical tramway, whose conditions were of an exceptionally difficult character, there being a grade of 1 in 8½ for a distance of eight chains.

We have to consider five points in connection with the overhead system:—1. The power-house or generating station. 2. The conductor from the power-house to the car. 3. The motor attached to the car. 4. The connection between the motor and the axle of the car. 5. The return of the current to the power-house.

Thrown on the screen is one of Sprague's power-houses (Plate IX.), supplied with Armington and Sims' engines connected up to the dynamos, and thereby supplying the necessary mechanical power for the production of the current, and in designing these engines it is desirable that they should be so constructed that no variation of more than 2 per cent. in the speed should take place, whether there is a small amount of work to do or whether they are called upon to develop their highest capacity at any given moment, and it is always necessary to have the chief parts in duplicate in case of accident.

The conductor from the power-house to the car has undergone many modifications, but the plan which is now generally adopted is a trolly wheel, firmly fixed to a balanced and pivoted pole having a universal movement. This projects from the roof of the car, and is kept in contact with the conductor or overhead wire by aid of springs from below pressing it underneath and against the overhead wire.

With regard to the overhead work a three-tenths of an inch copper wire is stretched over the centre of the track. At every 120 feet it is suspended about 20 feet above the level of the street. This is done either by means of a bracket, as shown on the diagram (Plate X.), or from a thin cable stretched across the street from kerb to kerb, attached to poles either of wood or iron. This, of course, necessitates the insulation of the main wire by means of a small insulator made of mica and indiarubber.

The poles are planted in concrete to a depth of 6 or 8 feet and a good earth connection made, so that leakage of current can be grounded. The poles are very ornamental in design, and are capable not only of any amount of artistic embellishment, but can be practically used for electric lighting. On short roads the overhead wire provides current for the whole of the motors on the track, but on long lines, where traffic is heavy, feeders are resorted to, carried overhead or underground, and connected with the main overhead wire at intervals of 400 to 500 feet by small lateral or sub-feeders. The important features of this excellent system are the maintenance of a constant potential along the entire length of the road, avoiding a breakdown of the system in case of fires, congested street traffic, or the rupture of the overhead lines. Traffic would still be carried on at either side to the breach, or if by placing cross-over roads in the track at the ends of these sections the inconvenienee would be slight.

The next point to be explained is the motor and the connection between the motor and the axle of the car. (Plate XI.) You already know the main functions of the motor. The current is conducted to the motor under the floor of the car. The mechanism consists of a motor fixed under frame of car. On the end of the motor shaft a pinion gears into a spur wheel on an intermediate shaft. On the other end of the latter another pinion gears into a spur wheel on the driving axle of the car, and motion thereby being communicated. The Sprague motors are perfectly automatic, running at nearly the same speed for all roads up to the maximum, and adjusts itself to normal speed under sudden changes in load. A diagram showing a street railway current curve gives an idea of the erratic power-calls on the motor. (Plate XII.) As regards the system of braking, when a motor is in operation it is generating an electro-motive force. In other words, it is acting like a dynamo, and since this depends upon the strength of the field magnet and the intensity of motion, and since the field magnet strength is under positive control, it follows that the electro-motive force can be made to equal the initial motive force, and even to exceed it when this electro-motive force of the motor thus predominates. The machine will then become a generator and give current to the rails, and its mechanical effects are reversed, so that it brakes the train instead of propelling it.

For controlling the cars a series of levers are worked on the platforms, and a "rheostat" is used for throwing machines into circuit. The last item to be determined is the return of the current to the power-house. There are many methods, as have already been pointed out, namely, by earth plates being buried in damp soil and by rail; but in recent practice the complete metallic return, the same as the overhead wire laid on the top of the sleepers and between the rails, and connected with the latter close to the joints, is pronounced to be satisfactory.

Of course many objections of an æsthetical nature have been urged against the overhead gearing, but they are more apparent than real, and those who take their stand on such paltry objections I would recommend to look at the telegraph and telephone cables so obtrusively conspicuous in big towns. The telephone people have also complained that the ground return interferes with the successful operation of the telephone. The same argument could be brought against electric lighting and telegraphs. The telephone people could meet this chief objection by having a metallic return constructed, the cost of which would be a mere bagatelle. As regards the risk to human life by shock, the working potentiality of 500 volts is so low that it is hardly worth considering. Having touched the fringe of the principal objections a brief comparison, *pro* and *con*, with other systems of traction will be considered. Traction expenses on horse tramways amount to two-thirds of entire working expenses, to say nothing of its inhumanity; and as to steam, it is a clumsy but effective method of applying force, and the citizens of Hobart would be wanting in public spirit if they ever permitted steam engines to run along their streets. If a draughtsman sat down and deliberately attempted to design an affront to a decent community he could not have succeeded better than at Sydney. The working expenses of the steam trams there amount to 3s. per train mile. It is now generally admitted that the struggle for existence lies between the cable system and the electric. The cost of the construction of the former in Melbourne amounted to £34,000 per mile, and 75 per cent. of the available energy is lost by dragging the cable itself, while the whole of the energy can be utilised by the overhead system, excepting a few points per cent. due to resistance of the current by the overhead wires, to say nothing of numerous mechanical defects. At Minneapolis £80,000 was spent in the purchase of cable plant, but was cast on one side as scrap iron to make way for an electrical system. The cable system can certainly surmount phenomenal grades, but on the other hand the electrical tramway can negotiate 1 in 8 grades, or even less; it is only a question of power; and Mr. Reis, an electrical engineer, has made some very valuable discoveries as to electrical braking and adhesion, which I hope to see practically demonstrated at an early date.

As much as one would like to submit these different tramway systems to a searching analysis of cost, not only as regards construction, but working and maintenance; but having already overstepped the limits of a paper, I can simply record the fact that the Frankfort-Offenbach line in Germany is the most expensively worked tramway in Europe or America, the cost amounting to 4½d. per car mile. Mr. Crosby summarises the cost of working, etc., three of the principal lines in America:—"Interest on investment, one-quarter to one-fifth of the whole, *i.e.*, 1 cent per car mile, or, say, 20 per cent. of the total. Coal is about 12 per cent., attendance 40 per cent., machinery and line (without interest) about 20 per cent."

Here is a view of the Telpherage system. (Plate XIII.) It requires no earthworks, bridges, culverts, etc., as railways do. There are three lines worked on this system in England—Alexandra Park, half a mile; Glynde, a mile and a half; and Eastpool a mile and a half; the latter two for mineral purposes. I throw the suggestion out that they are admirably adapted for the developments that are taking place at the present time on the West Coast. It is difficult indeed to surmise what shape electrical developments will take in the future, its potentiality being apparently infinite. It is, however, no stretch of the imagination to say that it is the locomotive power of the future. In preparing this paper I have consulted Professor S. P. Thompson's works, Professor Ayrton, Du Moncel, Martin and Wetzler, and other scientific papers. (Plate XIV.)

DISCUSSION.

Mr. Macfarlane said:—Your Excellency and Gentlemen,—Having been asked to take part in the discussion following Mr. Montague Jones' excellent paper, I have pleasure in doing so, as I have had opportunity of gathering some information on this interesting subject, being in correspondence with a manufacturing company, makers of electric railway plant, the Thomson-Houston Company. There are only two or three points which I would desire to emphasise as of special general interest to the public, and the first point is that electric traction is not now confined to the region of scientific experiment, but is an established commercial success. In the United States there are 310 tramways or railroads worked by electricity, with 4,000 cars and 7,000 motors. In the city of Minneapolis a new and expensive cable has been abandoned and electricity adopted, and it is estimated that one-third of the street railway mileage in the States is worked by electric traction; and further, the following tramways, amongst others, pay a dividend of 8 per cent.:—The West End Road, Boston (probably the largest tramway company in the world), the Springfield, Troy and Lansenbury, and Utica and Mohawk tramways. These facts are sufficient to show that electric traction for tramways and railroads is a commercial success. I am speaking now of the overhead system, and on the general principle, for, of course, there are electric railroad companies which do not pay dividends, as in all commercial ventures. With regard to steep grades I may add 1 in 7 is not too steep for working. I believe the steepest grade in the proposed Hobart line is 1 in 16.

It is interesting to note further that electric traction has also been successfully applied to tramways for mills and manufactories, as well as to street railways, and is found a convenient method of transporting raw materials, manufactured products, coal, and other commodities from one part of the works to another. Electricity fully meets the requirements of such a case. The special advantages claimed for electricity over steam motors or locomotives are three in number, viz., safety, the removal of obstacles presented by grades, and economy. Its safety is seen from the fact that the road may be run through the mills and store-houses without increasing the insurance rates. Steam is unsuited to indoor work, and even when used entirely out of doors there is always some danger of fire, and there is the smoke and the noise and dirt arising from the locomotive. In the matter of grades, whilst 4 per cent. (1 in 25) is about the maximum which steam can overcome, grades of 12 per cent. (1 in 8½), or more, are easily surmounted by electricity. The expense for horse-power of running a steam locomotive in comparison with a large stationary engine, where all the advantages of concentration are available, shows decided economy in favour of the large plant. Electricity furnishes a means for transmission of power with minimum loss and cost, permitting the concentration of the generating plant, whether steam or water power, and thus appeals strongly to the business man on the ground of economy. One advantage possessed by electricity alone is that the overhead wire may be tapped anywhere, and a stationary motor, an electric hoist, a pump, or any form of electric-power machine operated from it. Electric traction is in use at the works of the Baltimore

Sugar Refinery, Pittsburgh Plate Glass Company's, Trenton Iron Works, and many other mills and factories.

As to the safety of the overhead wire system in regard to freedom from accident or danger to human life, it is very satisfactory to have reliable and independent testimony apart from experts or officials connected with manufacturing companies. The *Boston Daily Advertiser*, the well-known Conservative journal of a Conservative city, addressed letters to the Mayors of the various cities in which the overhead system of electric tramways was in use. The questions submitted were:—1st. What system of electric cars is in use in your city? 2nd. Whether any persons have been seriously injured or killed? 3rd. Whether any apprehension is felt among your people as to safety on account of this electric system? 4th. Whether, as a result of its introduction, the street car service is improved? 5th. Whether popular feeling is in favour of the overhead wires, or hostile to it? In reply 69 answers were received from as many cities, which were published in the *Advertiser*, appearing on the 26th August, 1890. In regard to the third, fourth, and fifth questions the consensus of public opinion is exceedingly favourable; and on the point of danger raised by the second question the *Advertiser*, in summing up, says:—"We find that of the 69 cities reports of accidents are confined to 15. Of these only 8 resulted in serious or fatal injuries to human beings, the others being the killing of horses by falling wires. Of the human beings killed, in all but two cases the accident was due to other causes than the electric wires, and in both cases where the wires apparently brought death they were by electric light wires. We have not heard of a single death from the trolly wire." It must be admitted this independent testimony is very satisfactory.

Nashville, Tennessee, claims to have the largest electric railway system in the States, excepting the city of Boston. And I will conclude this short sketch with an extract from the Mayor of Nashville's letter in reply to the questions submitted by the *Boston Daily Advertiser*:—"No person has been injured by the system. Three horses have, however, been killed, caused by rusted telephone wires falling across the trolly wire and conveying the current from the trolly wire to the ground. In one instance when one of these accidents occurred a Negro woman, in attempting to pass, grabbed"—[Excuse the expression; it is not mine, but the worthy Mayor's.]—"the telephone wire, and was thrown to the ground. She naturally did right smart 'high kicking,' but she immediately arose, much frightened, but in nowise injured. From this it seems that while the trolly wire conveys sufficient electricity to kill a horse, yet there is not sufficient current to kill a human being."

Mr. C. W. S. **James**, C.E., said he had been deeply interested in the paper read, and had tried to think how far the electric traction system could be applied to Hobart. A few months ago he had estimated what could be done in Launceston by utilising the South Esk River, and he thought that there from 1,000 to 1,300 horse-power could be available. In regard to Hobart, however, there was not the same power available, and he believed they would require to look to generated power in any electrical system introduced. He thought the system could be usefully applied to carrying minerals on the West Coast, and that the "overhead system" was well adapted for the streets of Hobart.

Mr. J. **Fincham**, C.E., said he had followed the paper with interest, but they had no reference to the length of the steep grades surmounted. He believed that in any scheme for electrical traction in Hobart this would be one of the difficulties. He was aware that there were about 300 tramways in America, but he had not been able to get any particulars as to the grade, or whether it was equal to such a grade as they had to contend with in going up Elizabeth-street.

Mr. A. W. **Lawder**, C.E., thought the length of grade to be overcome simply resolved itself into a question of the power of the accumulator.

Mr. **Fincham** said that was just the difficulty the engineers found. They had not been able to provide enough accumulation to overcome a sustained strain.

Mr. **Jones**, in reply, said Mr. Fincham appeared to associate the "storage system" with the practical operation of electric trams, but it was clearly pointed out that the "storage" up to the present time was an ideal method, and that the "overhead system" was the only one of practical value. The main defects of the former are the limited capacity of the cells, and when brought to bear on a grade of 5 per cent. heat instead of current was developed, which buckled the cell plates, rendering them useless; and, again, the cells are composed of lead, weighing altogether 3,500lb., which has to be carried about over light as well as the heavy grades, losing 60 per cent. of the available efficiency. Coming to the "overhead system," the question of surmounting heavy and continuous grades resolves itself into a question of increased power, which is always to be obtained from the central station, and herein lies the great advantage the overhead system has over any other. All the available energy can be-utilised excepting a few points per cent., due to the resistance of the current by the conductor. The maximum grade in Hobart is 1 in 16, and is slight compared with some of the towns where cars are being operated by electricity. The following is an extract from a letter from the directors of the "Richmond Union Passenger Line" to Mr. Sprague:—"The road which you have equipped under most trying conditions has been one of the most, if not *the* most, difficult which could be met with in street railway work. The excessive and continuous grades, the numerous sharp curves, the gradients in these curves, the weight of the cars, and the heavy loads which they have been required to carry, together with the extent of the system, and the number of the cars in operation (about 40), constitute the enterprise the largest and most difficult yet inaugurated in any part of the world. We acknowledge the successful fulfilment of all the terms and conditions of the contract, and compliment you upon having achieved so signal a success." The number of street electric railways at work, and the number contemplated, is quite sufficient to prove that it has long since passed the experimental stage of development. Citizens of Hobart should keep these facts in view, and refuse to listen to any argument stating it to be impracticable to introduce an electric service here. The wretched apology for a permanent way will certainly have to be removed, and a neat steel-grooved rail put in its place, as the basis of efficient street transit is a smooth and sound rolling surface. I would also like to see a 4ft. 8½in. gauge, instead of a 3ft. 6in. gauge, as the latter might create mechanical difficulties which cannot at present be foreseen, as all the electric roads, or nearly so, are built to 4ft. 8½in. requirements. Of course these difficulties would be overcome; still it is just as well to be on the safe side. As regards a prime source of power for Hobart, it is a simple question of cost and maintenance whether water or steam would be better. There is plenty of water, and the cost to supply a constant head would be, I think, much less than coal. Two hundred h.p. would be more than sufficient force for a service of 12 cars, and as to the mechanical power for equipment it does not make much difference whether the grades be 1 in 5 or 1 in 10, as the motors used are of a standard size, having a capacity of 15 h.p. each. Where the grades do not exceed 4 to 5 per cent, one motor could do the work, but where the grades exceed 5 and run up as high as 10 per cent., then it is unsafe to operate, except by driving both axles, and then the equipment must be two 15 h.p. motors. The average weight for street motors' equipment is about 100lb. per h.p Hence 2·15 h.p. motor equipment will weigh about 3,000lb. I have deduced this to mathematical formulæ following:—H.P.$=4{\cdot}75=$M.T. (C x 1), where M=miles per hour, T No. of tons, C rise in feet per 100. The cost of single line "overhead" construction, including permanent way material, under average conditions should not amount to more than £3,500 per mile. This, in comparison with the cable system at Melbourne at £34,000 per mile is very marked, and the economy of the overhead system is so manifest that Mr. Henry Peabody, of Boston, wrote to me as follows, in reply to inquiries:—"There is a feeling among all Municipal Councils, where railways apply for overhead lines, that the increased economy warrants their asking for a decrease of fares, hence their desire to keep quiet about their balance-sheets." Mr. James asked me to explain the Telpherage system. There are two, "the series," and the "cross ones parallel." The latter is now being operated in many places. The skips or trucks are suspended and supported by iron rods, which are likewise supported by poles, and the lower rod, acting as a conductor, is constructed on the "break and make" principle at every 120ft. or so, taking its supply of current from a dynamo fixed at a convenient place. The "makes and breaks" are normally closed, so that a current of electricity may flow from end to end; but when the first wheel of the skip of a train touches the "break," the circuit is closed, and the current runs back to the last wheel of the train, and into the skip containing the motor, and thereby energising the train. The same operation continues at the intervals stated to the end of the journey. It can be worked up to 15 miles per hour with ease, and the cost of carrying is about one halfpenny per ton per mile. Unlike most new inventions, "Telpherage" does not persist in adhering to any principle of an obsolete type, but is an innovation so extraordinary as to pass all practical experience. As feeders to the West Coast lines nothing could be more admirable, and not in the remote future we shall see it universally adopted, instead of those useless unpayable lines and costly roads that cripple the resources of new countries.

NOTES ON THE SHELL-MOUNDS AT SEAFORD, LITTLE SWANPORT:

By Alfred J. Taylor, F.L.S., F.R.G.S.,E.

Among the many interesting relics of the Aborigines of Tasmania that yet remain, not the least interesting are the shell-mounds that mark the spot where they formed their encampments and feasted before the intrusion of a white race had disturbed their simple and peaceful modes of living. Such shell heaps as that to which I am about to refer occur in other parts of the world, and for some time they were supposed to be nothing more particular than ordinary "raised beaches." Even now in Tasmania there are many well-informed people who cannot bring themselves to believe that the shell heaps noticeable in many places on our shores are the kitchen-middens, or "refuse heaps," of the Aborigines of the colony; and it is for the information of such sceptics that I place on record the following evidence as establishing beyond all reasonable doubt the fact that they are this, and nothing more. One has only to examine these remarkable accumulations to obtain evidence of an intensely interesting and convincing character, and the results of a personal examination of the extensive shell mounds to be found on the estate leased by Mr. Samuel Drake at Little Swanport have induced me to hope that a few notes on the subject may be of some interest to the Fellows of this Society. It may be as well, I think, to prelude what I have to advance as direct evidence in favour of my contention by briefly referring to one or two of the reasons why the accumulation of shells at Little Swanport cannot be regarded as having been due to the upraising of oyster beds, or as having been due to the wash of surf upon the spot. In the first place, although it can be shown that at some places where shell mounds occur in the colony live and dead shells are thrown up by the surf, at Little Swanport there is no wash or surf to cast up shells, for while the plunging seas roar on the bar outside, the waters within are, as a rule, as still and as peaceful as the waters of a mill pond. The conclusion that the shell beds have been upraised from the sea is disposed of by the natural features that distinguished true raised beaches from kitchen-middens or refuse heaps. Sir John Lubbock, in his "Prehistoric Man," has drawn attention to the fact that raised beaches contain species the individuals of which are of different ages, and that the shells are, as a matter of course, mixed up with a large amount of sand and gravel. He also quotes Professor Steenstrup, who, in combating the idea that the shell mounds of Denmark were raised beaches, directed attention to the circumstance that "the shells belonged entirely to full-grown or to nearly full-grown individuals, and that they consisted of four species which do not live together, nor require the same conditions, and would not, therefore, be found together in a natural deposit; and thirdly, that the stratum contained scarcely any gravel, but consisted almost entirely of shells" (pp. 224-5). This reasoning applies exactly to the shell mounds at Little Swanport: for not only is there an absence of anything like stratification or admixture of much sand or gravel with them, but the whole of the oyster shells that have come under my notice are of mature growth, and are mixed up with other species that do not live together. In connection with this negative evidence I may throw out the consideration that if these deposits were merely the indications of an upraising it would only be reasonable to anticipate that many of the shells would be found in natural pairs. Such, however, is not the case at Little Swanport, the shells that I noticed during my recent visit to that very pleasant and interesting spot being, in every instance, single shells scattered just as we might expect to find them in refuse heaps. Another noticeable feature in the mounds at Little Swanport is the fact that a very large proportion of the shells are broken at one particular part, as if they had been broken there to assist in the process of opening them. It is also noticeable that many of them have undergone the action of fire. To turn to the more direct evidence. The encampments of the Aborigines were always formed on the margin of streams or lagoons. Possessing no appliances for digging or sinking wells, it was a matter of importance to them to be near fresh streams or springs. On the spot where the shell mounds are thickest, at Little Swanport, there is a splendid fresh water spring, which bubbles up within a few yards of the bay, yielding a plentiful supply of the sweetest fresh water. Their place of encampment depended also upon the food obtainable, and as the daily food of those living near the Coast consisted largely of shell fish, such as oysters, turbos, and haliotis or mutton fish, they would naturally resort to such a favoured spot as Little Swanport, where these, together with the crayfish, another article of their diet, could be found in abundance. As a matter of history, it is known that a very large tribe of natives, known as the Oyster Bay tribe, frequented the spot, and during my recent visit to it I was able to discover some very interesting indications of the primitive conditions under which they existed. When I first decided to turn the shell heaps into lime of commercial value, it struck me that many articles of ethnological interest might be discovered, and I gave strict instructions to the parties employed to send me all bones or remarkable stones that they might come across in breaking down the shells for the kiln. It was not long before I had the pleasure of receiving a parcel of bones—the remains of the marsupials the natives used to feed upon—and I at once noticed that the larger ones had been split, evidently for the purpose of extracting the marrow. At a meeting of the Royal Society of Tasmania in 1873 Mr. James Scott volunteered certain information received from his brother, Mr. Thomas Scott, who, among other things, referred to a stone which he had sent to England—" A round stone chipped all round to a circle about 7in. in diameter, and 1½in. thick in the centre, to 1in. at the edge. On this the females broke the bones of animals for the marrow, using another stone about 6in. in diameter for striking." I am able to exhibit a stone exactly answering this description, which I took from the surface of one of the shell-mounds. It will be noticed that at the middle part on one side it has been worn smooth by the friction of use. I also found mixed up with the shells other round water worn stones, evidently used for the same purpose; for in the Transactions of the Ethnological Society for 1863 there is a statement made by Mr. Milligan to the effect that the Aborigines had assured him that round stones of different sizes, together with chipped flint instruments, would be found in the shell-mounds left on the scenes of their feasts. Bearing in mind the latter portion of this statement, I was very anxious to find some of the chipped flints, and made a careful examination of the surface of the shell-mounds. You may imagine my delight when my eye rested on a well marked one which had been turned up in ploughing. Further examination led to the discovery of several others of the same character. But I was not yet satisfied, as I had found them all upon the surface. Being anxious to test the extent of the shell deposits, I got my companion, Mr. W. Luttrell, to put down a few prospecting holes, and in sinking one of these we came across a well-chipped flint, buried in the shells some 12in. below the surface. There is one significant fact in connection with the bones found in these shell-mounds, and, indeed, with the shell heaps alone, and that is the constant occurrence of charcoal—the remains of the fires kindled by the natives to roast the animals and to cook the shell fish "in their own gravy." It is known that to do the latter the large shells were placed upon the fire as dishes, and that this method of cooking rendered the contents tender and succulent. The presence of the charcoal under such circumstances affords another link in the chain of evidence that bears out the certainty that these shell-mounds are something much more interesting than upraised beaches or oyster beds. Perhaps the most interesting of the "finds" yet made in connection with the shell-mounds at Little Swanport has been the discovery of a bone (which I now exhibit) which gives evidence of having been worked or ground. As far as I know it is the first bone instrument of the kind that has yet been referred to in connection with the history of the Aborigines of this colony. It was discovered by Mr. Herbert Luttrell in breaking down the shells from one of the faces opened to supply the kiln. Mr. Ronald Gunn has stated that in removing haliotis or mutton fish from the rocks to which they closely adhere the natives used a wooken spatula-shaped instrument, and Backhouse writes that the mutton fish were often taken in deep water by the native women, who dived for them and forced them off the rocks by means of a wooden chisel. The French explorer, La Billardiére, saw how these chisels were made. "We observed," he writes, "some of the savages employed cutting little bits of wood in the form of a spatula, and smoothing them with a shell, for the purpose of separating from the rock limpets or sea-ears on which to feast." I think it quite probable that the bone instrument before us was used for a similar purpose. On examination it will be found that it is somewhat worn just at the spot where it would be most likely to show the effects of friction if used to work and lever the sea-ear from the rock. In any case it is interesting, as indicating one step towards a degree of civilisation that the Aborigines of the colony were destined never to reach. In putting down the prospecting holes above referred to I satisfied myself that the shell deposits at Seaford extend over several acres of ground, varying in depth from 6in. to 6ft. It is the vast extent of these deposits that renders it almost impossible for anyone at first blush to realise that they are the refuse heaps of the Aborigines. When it is remembered, however, that the tribes near the sea-shore lived principally on shell fish—for, according to Calder, and other authorities, the natives of Tasmania would rather have starved than use any kind of scale-fish for food—it will easily be seen that large refuse heaps would very rapidly accumulate on the feeding grounds. The best authorities agree that the natives were very ravenous eaters, and setting the number of the Oyster Bay tribe at 500 (an estimate I have heard given), and putting down to the account of each member of the tribe a consumption of 20 oysters per day, that small calculation alone would give 20,000 single shells per day to the refuse heaps. There is one thought in connection with this matter with which I will conclude my somewhat desultory notes. Lubbock has pointed out that—"A country, the inhabitants of which live by hunting and fishing, can never be thickly populated." Regarding the shell-mounds at Little Swanport in the light of this fact, and taking into consideration their vast extent, the conclusion is forced upon us that the spot must have been frequented by the natives for a very long period of time, and this is a fact that should not be lost sight of when efforts are being made to trace their history and origin. It now only remains for me to mention that we are about to turn these interesting shell-mounds into a valuable article of commerce, and should anything of interest be discovered during their removal, it will give me great pleasure to make the Fellows of this Society acquainted with the fact.

DISCUSSION.

Mr. R. M. Johnston said he was very pleased to find Mr. Taylor had taken so much trouble in obtaining such valuable information dealing with the Aborigines of Tasmania. The paper read by Mr. Taylor was extremely interesting from an ethnological point of view. He, Mr. Johnston, had made a close study of these native "kitchen middens" for many years, and in his work on "The Geology of Tasmania" he had devoted a considerable space to the description of these interesting deposits so common along the borders of our estuaries and coasts. The particular shell deposit at Little Devonport, referred to by Mr. Taylor, had been investigated by him about two years ago, and his observations then made, in company with Mr. Morton and other members of the Fishery Board, left no doubt in his mind that the deposit was simply one of the many kitchen middens of the Tasmanian Aborigines abounding everywhere along our coast lines in similar situations. The lenticular layers of ashes and charred wood, intercalated with the shells, were then observed by him, and pointed out to those who were with him as proof of their accumulation by human agency. He could therefore confirm the accuracy of Mr. Taylor's descriptions and conclusions. Anyone who has had the slightest experience in observing these interesting deposits, now fast disappearing or being obliterated by the agriculturist's plough and other agencies, would never confound them with the raised beaches so common in Bass Strait Islands and along portions of the northern coast.

Mr. Johnston then drew attention to the numerous kitchen middens existing all along the borders of the estuary of the Derwent, and especially along the Domain, New Town Bay, mouth of the Jordan, One Tree Point, and Blackman's Bay. These are generally formed on little knolls or headlands, commanding a good outlook on every side. One interesting mound exists high up on the Domain, near the New Cricket Ground. From all of these he had collected the chipped flints, and occasionally split bones of the wallaby. Over 150 chipped flints had been collected by him from these deposits near Hobart, and a very large number had recently been sent to him, collected by Mr. John Morrisby on the borders of Pipeclay Lagoon, South Arm.

He stated also that he had recently received a communication from Mr. Mitchell, of Lisdillon, who tried upon the basis of the extent of these shell deposits to make some estimate as to the length of time during which the Island was occupied by the last Tasmanian race. Mr. Johnston stated that an estimate formed in this way would be very unsatisfactory, as the kitchen middens are formed for the most part on the marginal boundaries of our seas and estuaries, and are constantly being encroached upon by the great invader, the sea. It is evident therefore that the horizontal encroachment of the sea would have destroyed the very earliest deposits, supposing them to have existed. It is almost certain from ethnological considerations that the Tasmanian Race must have existed in Tasmania for a very long period, for otherwise how can we account for the marked racial type as compared with the natives of the Australian mainland and elsewhere.

REPORT

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1891.

Tasmania:
WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1892.

ROYAL SOCIETY OF TASMANIA.

Patron:
HER MAJESTY THE QUEEN.

President:
HIS EXCELLENCY SIR ROBERT GEORGE CROOKSHANK HAMILTON, K.C.B.

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MINUTES of the Annual General Meeting of the ROYAL SOCIETY OF TASMANIA, *held at the Royal Society's Rooms on Tuesday evening, 5th April,* 1892,—JAMES BARNARD, *Esq., Vice-President, in the Chair.*

THE following gentlemen were elected Corresponding Members:—Messrs. A. Sydney Oliffe, Government Entomologist, N.S.W.; G. M. Thomson, F.L.S., Principal of the High School, Dunedin, N.Z.; J. Shirley, B.Sc., of Brisbane, Queensland; W. M. Hamlet, F.C.S., F.I.C., Government Analyst, Sydney; Professor W. Bragg, M.A., of the Adelaide University; T. W. E. David, F.G.S., of the Sydney University; W. Baldwin Spencer, M.A., of the Melbourne University; and Dr. A. Dendy, D.S.C., Melbourne University.

The following persons were elected Fellows of the Society:—John Deans, M.D., Miss May Dickson, the Rev. Herbert R. Finnis, and Messrs. Henry H. Anderson, B.A., and John Goodall, C.E.

REPORT.

The Council of the Royal Society of Tasmania have much pleasure in submitting the following Report for 1891.

The first monthly meeting took place on April 22nd, when the President, His Excellency Sir R. G. C. Hamilton, K.C.B., occupied the Chair, there being a good attendance of Fellows, Lady Hamilton and several ladies being also present. Mr. A. Morton, who, in conjunction with Mr. C. H. Grant (then absent from the Colony), had been appointed as Delegates from the Royal Society to the third meeting of the Australasian Association for the Advancement of Science held at Christchurch, New Zealand, in 1891, gave an interesting account of their proceedings, reporting that Hobart had been fixed as the next place of meeting, and that His Excellency Sir R. G. C. Hamilton had consented to fill the important office of President.

Six meetings of the Society have been held, that of November having been postponed owing to the near approach of the Science Congress in January.. All the meetings had been well attended by the Fellows.

Thirteen papers have been read, on many of which interesting discussions took place. His Excellency had been present in the Chair on all occasions. The subjects of the papers read were:—

By H. H. Montgomery, D.D., Bishop of Tasmania.

1. "Account of the Mutton Birds or Sooty Petrels, as seen in their homes among the Furneaux Islands, Bass Straits, Tasmania."

By R. M. Johnston, F.L.S.

2. "Notes on a Collection of Plant Impressions from the Henty River."

3. "Observations on the Causes of Elevation and Subsidence of the Earth's Crust."

By Baron von Mueller, K.C.M.G.

4. "Remarks on some Rare Tasmanian Plants."

By A. B. Biggs.

5. "The Possibilities of the Telescope."
6. "Total Eclipse of the Moon, May 24, 1891."
7. "The Transit of Mercury, May 10, 1891.'

By F. Danvers-Power, F.G.S.

8. "Notes on the Mount Lyell District, No. 1."
9. "Notes on the Mount Lyell District, No. 2."

By F. J. Jacobs, A.T.A.

10. "Note on the Arithmometer as an aid to Actuarial Work."

By W. Spencer, M.D., M.R.C.S. Eng.

11. "Hypnotism and alleged Phenomena."

By A. J. Taylor, F.L.S., F.R.G.S. Eng.

12. "Notes on the Shell Mounds at Seaford, Little Swanport."

COUNCIL.

No change has taken place during the session.

LIBRARY.

The most noteworthy circumstance in connection with the Library has been the completion of the rare and expensive work "The Birds of Asia," by J. Gould, F.R.S., the remaining 23 parts being a munificent gift to the Society by the Hon. J. W. Agnew, M.D.

FELLOWS.

Six Fellows and two Corresponding Members have been elected; twenty have been lost through resignation or death. The hearty congratulations of the Council were, during the session, given to Mr. James Barnard and the

Hon. Dr. Agnew, who in May celebrated their jubilee as Members of the Royal Society of Tasmania and its precursor, the Tasmanian Society for Natural Science.

FINANCE.

The income has been:—Subscriptions to Royal Society, £175; fixed deposit, £208; interest, £10 18*s.*; total, £393. Expenditure, £235 1*s.* 1*d.*

In moving the adoption of the Report the Chairman stated that the meeting would have been held in January but that the meeting of the Australasian Association for the Advancement of Science took up the whole of the time of those engaged. The Society had met with great success, for which the thanks of the Members were due to the liberality with which their requests had been met by the Parliament of Tasmania. The Municipal Corporation also deserved thanks for the manner in which they had given space at the Town Hall to hold the lectures in. The Committee had used almost superhuman exertions to make the affair a success, and from the results which had attended the labours of those engaged there was no doubt but that the whole had been a most undoubted success.

Mr. C. H. Grant seconded this, which was carried.

Votes of thanks were moved by Mr. C. Belstead and seconded by Mr. C. H. Grant, to the Auditors for the work carried out by them during the past twelve months, they being re-elected to fill that position; and by Mr. A. Morton, seconded by Mr. C. H. Grant, to the Press as follows:—"That a vote of thanks be accorded the Press for its valuable services in promoting the objects of the Royal Society by its ready and accurate reports of the evening meetings, and in various other matters,"—both of which were carried unanimously.

Mr. Morton, in moving the above, spoke in feeling terms of the services rendered by the late Mr. J. Johnson, formerly a member of the reporting staff of *The Mercury*. The seconder and the Chairman also endorsed the remarks made by the Secretary, after which the meeting terminated.

STATEMENT of the Funds of the ROYAL SOCIETY *for Year ending* 1891.

Receipts.	£	s.	d.	£	s.	d.
Balance from 1890	28	12	0			
Fixed Deposits	208	0	0			
				236	12	0
Subscriptions		...		175	10	0
Refund Weaver's Cheque		...		1	1	0
Interest on Fixed Deposit	10	18	0			
Ditto	10	8	0			
				21	6	0
Bank Balance per Pass Book Credit	5	19	1			
Interest drawn in error	0	5	0			
	6	4	1			
Outstanding cheques £9 6*s*. 8*d*.; £15 17*s*. 6*d*.	25	4	2			
				19	0	1
				£453	9	1

Expenditure.	£	s.	d.
Salary of Secretary	50	0	0
Ditto Attendant	6	0	0
Current Expenditure	179	1	1
Fixed Deposits	218	8	0
	£453	9	1

Examined and found correct.

JOHN MACFARLANE.
FRANCIS BUTLER.

***29th March*, 1892.**

STATEMENT of the Funds of the Morton Allport Memorial Fund *for the Year* 1891.

1891. Dr.	£	s.	d.	Cr.	£	s.	d.
Balance as per statement for 1891...............	68	1	4	Purchase Buller's "Birds of New Zealand"	13	13	0
Interest	2	14	6	Balance in Savings Bank to credit of Fund	57	2	10
	£70	15	10		£70	15	10

Examined with Savings Bank Book, and found correct.

JOHN MACFARLANE.
FRANCIS BUTLER.

29*th March*, 1892.

WILLIAM THOMAS STRUTT,
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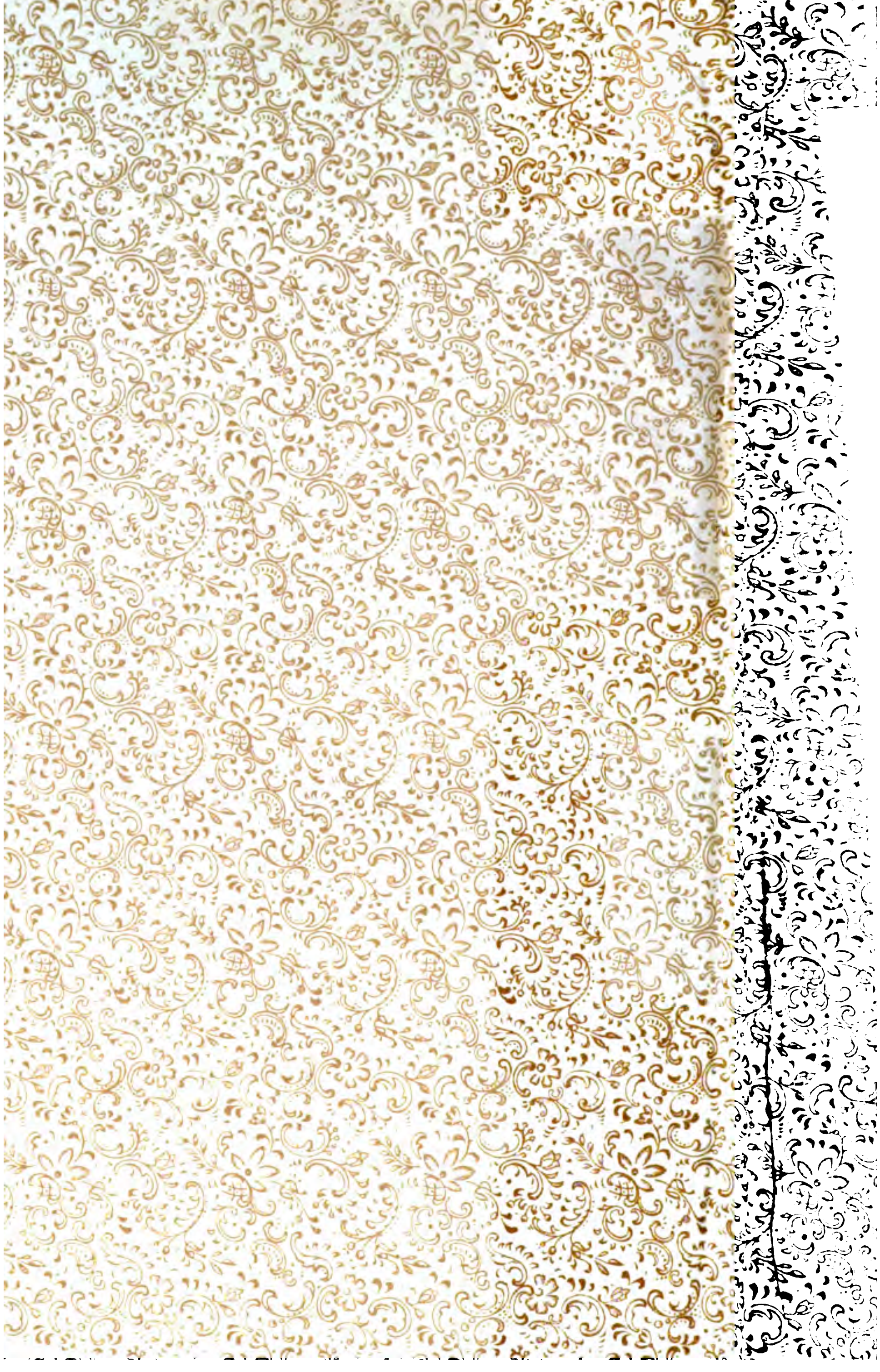

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